1969

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INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE AND PINK SALMON FISHERIES IN
THE FRASER RIVER SYSTEM

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ANNUAL REPORT

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W. R. HOURSTON
RICHARD NELSON

NEW WESTMINSTER
CANADA
1970

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

MEMBERS AND PERIOD OF SERVICE SINCE THE INCEPTION OF THE COMMISSION IN 1937

CANADA

William A. Found	1937-1939
A. L. Hager	1937-1948
Senator Thomas Reid	1937-1967
A. J. Whitmore	1939-1966 1968-
Olof Hanson	1948-1952
H. R. MacMillan, C.B.E., D.Sc.	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-
Richard Nelson	1966-

UNITED STATES

Edward W. Allen	1937-1951 1957-1957
B. M. Brennan	1937-1942
Charles E. Jackson	1937-1946
Fred J. Foster	1943-1947
Milo Moore	1946-1949 1957-1961
Albert M. Day	1947-1954
Alvin Anderson	1949-1950
Robert J. Schoettler	1951-1957
Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
George C. Starlund	1961-1966
Clarence F. Pautzke	1961-1969
DeWitt Gilbert	1957-
Thor C. Tollefson	1966-
Charles H. Meacham	1969-

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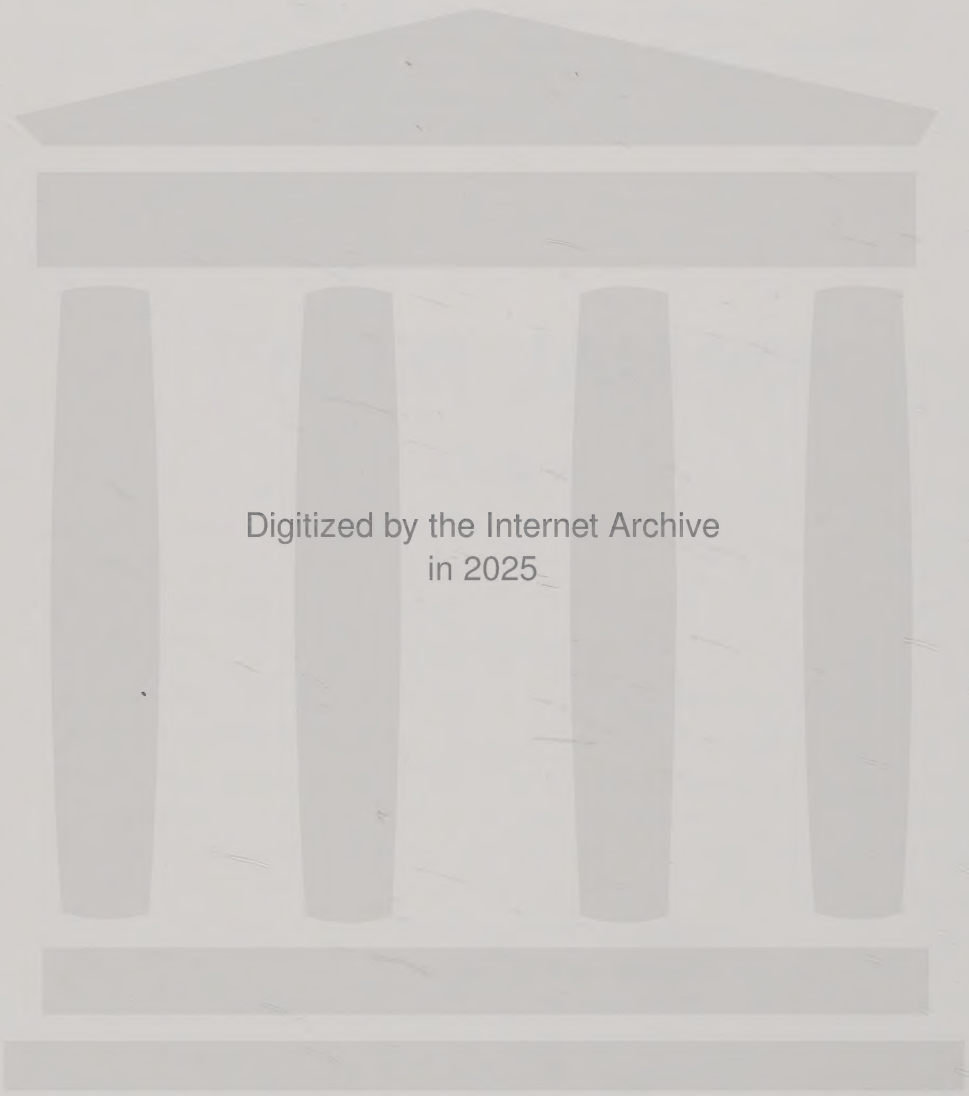
DIRECTOR OF INVESTIGATIONS
LOYD A. ROYAL

NEW WESTMINSTER
CANADA
1970



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REPORT OF THE
INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION
FOR THE YEAR 1969

The terms of reference of the Sockeye Salmon Fisheries Convention, as amended by the Pink Salmon Protocol, specify that the Fraser River sockeye and pink salmon shall be protected, preserved, and extended as a mutual source of wealth to Canada and the United States. In the 1968 Annual Report, the Commission summarized the benefits accruing to date from its rehabilitation operations. It emphasized also, on the basis of extensive research, that substantial benefits might result from the construction and operation of artificial spawning and incubation channels, not only where natural spawning grounds had deteriorated from the effects of logging and land-clearing operations, but also where the available rearing capacity of certain lakes was not fully utilized because of limited natural fry production.

In recent years the Commission has requested $300,000 annually for the construction, among other things, of prototype spawning and incubation channels to save certain sockeye and pink salmon populations from serious depletion due to deteriorating spawning grounds. In most instances the United States Government has restricted its contribution to approximately $100,000, thus limiting total annual expenditure for the referenced purpose to $200,000. In spite of this very limited expenditure, recent returns indicate the great potential value of artificial channels.

In 1963, an artificial incubation channel, with a capacity of 4 million eggs and costing $84,000, was placed in operation on Seven Mile Creek, tributary of Upper Pitt River. After analyzing all available data, it is calculated that 97,000 adult sockeye returned from the first year of operation, producing a catch of 88,000 fish worth $211,000 to the fishermen, or $400,000 after processing. In 1969, final returns from the second year of operation were obtained. Preliminary calculations reveal that approximately 115,000 adult sockeye were produced by the channel, and the catch of 98,000 taken in the fishery returned a gross income of $236,000 to the fishermen, or $447,000 after processing.

Although the total escapements in the brood years involved were relatively small (because of a continuing decline in the Pitt River sockeye population over the past 15 years), operation of the channel during the first two-year period resulted in the second largest and the largest sockeye runs to Pitt River on record. Furthermore, these large runs have produced increased escapements to Pitt River, in spite of heavy fishing on the Pitt River run which is necessary in order to harvest the first part of the Chilko and Horsefly runs that tend to suffer a heavy prespawning mortality. Thus in spite of a deteriorating natural spawning ground and heavy fishing pressure, the Pitt River escapement is increasing after a 15-year decline, largely because of a small incubation channel costing $84,000 in capital charges, $12,000 in annual operating charges and $5,328 in interest and depreciation. The benefit-cost ratio for the second year of operation is calculated to be 14 to 1.

In 1965, an artificial spawning channel, with related water storage and temperature control, was completed adjacent to Weaver Creek at a capital cost of $275,000. The channel has a theoretical capacity of 13,000 adult female salmon, but only 2,986 female sockeye, 497 female chum, and 32 female pink salmon entered the channel in its first year of operation. The first adult sockeye returned to the channel in 1969 when 59,000 spawners escaped to the Weaver Creek area, and an estimated 110,000 were caught by the fishermen for a total run of 169,000 Weaver sockeye. The escapement not only increased from 11,000 in the brood year to 59,000, but was substantially larger than any previously recorded.

The increased sockeye catch produced by Weaver Creek channel has a calculated value of $221,000 to the fishermen, or $419,000 after processing. Using the fishermen value of $221,000 for the increased catch, less $30,000 for operating, depreciation, and interest charges, the channel produced an income of $191,000 to the fishermen plus an increased escapement with a greater potential for future years. With the channel filled to less than one third capacity in its first year of operation, the benefit-cost ratio is still a remarkable 7 to 1.

The increased escapement to Weaver Creek in 1969 made it possible to fill the channel to capacity for the first time, and provides an opportunity to determine the total fry emergence from the 9,671 female sockeye spawning in the channel, as well as from the increased number of natural spawners. There was an increase also in the number of chum salmon spawning in Weaver Creek in 1969. The number of chum females utilizing the channel increased from 487 in the brood year to 1,286 in 1969, indicating additional yield to the fishing industry from the Weaver Creek channel in its first year of operation.

The Commission's first experimental spawning channel for pink salmon, constructed with research funds at a cost of $35,000, was located adjacent to Seton Creek in 1961. A second channel at Seton Creek with a 20,000 fish capacity was completed in 1967 at a capital cost of $218,000. Total production of pink salmon from artificial spawning channels cannot be assessed accurately because of the straying habit of spawners within a watershed that appears inherent in this species. However, in spite of an estimated loss of 10 million naturally hatched alevins due to an unfortunate flooding of Seton Creek by British Columbia Hydro in the late winter of 1968 and a poor overall fry-to-adult survival of the 1967 brood which returned in 1969, the total pink salmon escapement to Seton Creek declined only 12% while the escapement to the neighboring Thompson River declined 45%. This is strong circumstantial evidence that artificial spawning channels for pink salmon are proving just as successful as those for sockeye.

Based on the recorded returns to date of adult sockeye and pink salmon produced by artificial spawning and incubation channels, these aids to reproduction obviously have excellent capabilities for protecting, preserving and extending the fishery, as provided for in the Commission's terms of reference. While each project requires careful investigation and design if it is to have a reasonable guarantee of success, the potential for expansion in this field is tremendous.

The Commission believes that further and expanded investment in this program has now been fully justified on the basis of the foregoing benefit-cost ratios. As was stated in the 1968 Annual Report, "This program must be extensive enough to bring about substantial gains and thus ensure that local government policy continues to prevent the Fraser River from being developed in a manner adverse to the maintenance of a very valuable fishery and food resource. Without the support of the government directly concerned with the development of the Fraser River watershed, the salmon fishery will gradually disappear.

"To achieve the *full* purpose of the Sockeye Fisheries Convention between the United States and Canada will require a new budget concept on the part of the two Governments, particularly the United States, from that predicated on past operation of the Commission which has been limited primarily to research and management of the fishery."

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held fifteen formal meetings during 1969 with the approved minutes of these meetings being submitted to the Governments of the United States and Canada.

The first meeting of the year was held on January 16 and 17 with Mr. DeWitt Gilbert serving as Chairman and Mr. W. R. Hourston as Vice-Chairman and Secretary. On January 17 the Commission met with its Advisory Committee composed of the following members:

Canada	*United States*
Frank Bublé Purse Seine Fishermen	John Brown Reef Net Fishermen
K. F. Fraser Salmon Processors	Robert Christenson Gill Net Fishermen
Peter Jenewein Gill Net Fishermen	Charles Mechals Troll Fishermen
R. H. Stanton Troll Fishermen	N. Mladinich Purse Seine Fishermen
H. Stavenes Purse Seine Crew Members	John Plancich Salmon Processors
Robert Wright Sport Fishermen	Howard Gray Sport Fishermen

The tentative recommendations for regulatory control of the 1969 sockeye and pink salmon fishery in Convention waters, as submitted to the Advisory Committee by the Commission on December 13, 1968, were reviewed and certain revisions made on the basis of representations of the Committee.

On April 13, 1969 the Commission met in executive session to discuss the effect of the expanding high seas coastal troll fishery and approved a letter to the two Governments requesting a feasibility study of regulating the troll

fishery. The preparation of a report to the two Governments on the Bellingham Bay pollution problem and the use of a new formula for collecting troll catch statistics were both approved.

The third meeting of the year was held in Kamloops, B. C., on May 13, 1969 to examine several administrative problems. The status of a reserve placed on Indian land for the eventual construction of additional fishways at Bridge River, the proposed Shuswap River-Okanagan Lake water diversion, corrective measures required for the protection of Fraser River salmon from the proposed dredging of Bellingham Harbor, and the need for expanding the program for constructing artificial spawning channels were discussed and appropriate action taken. The proposed budget for 1970-1971 was accepted with the understanding that additional construction funds would be required beginning in the fiscal year 1971-1972 if the Commission was to fulfill its terms of reference.

Ten formal meetings and several telephone conferences were required between July 28 and October 2, 1969 to achieve, by adjustment of fishing regulations, the desired escapement and equitable division of the allowable catch of Fraser River sockeye and pink salmon. One of the referenced meetings, held on August 21, 1969, included members of the Advisory Committee to discuss the regulatory problems related to the failure of the pink salmon runs to appear in expected abundance.

The Commission met in executive session on November 13 and 14, 1969, primarily to review the 1969 sockeye and pink salmon fishery and the problems related to prespawning mortality in certain racial escapements. The Commission agreed to proceed with the construction of an artificial spawning channel on the Upper Nadina River using available funds to be supplemented by later appropriations.

The fifteenth and final meeting of the year was held on December 15 and 16, 1969 with the first day devoted to general business. The retirement of Mr. A. J. Whitmore after 29 years of service as a Canadian Commissioner was reported, his retirement being effective December 31, 1969. Mr. Charles H. Meacham, appointed by the President of the United States to replace Mr. Clarence F. Pautzke, was welcomed as a United States Commissioner. The Commission accepted the resignation of Mr. R. H. Stanton, Canadian representative of troll fishermen, in view of his stated intention to discontinue active participation in the fishery. The appointment of Mr. Michael Guns as his successor was approved unanimously. The characteristcis of the 1969 fishing season, the related escapements and spawning environment, and a summary of possible factors influencing the size of the 1970 Fraser River sockeye run in Convention waters were presented to the open meeting on December 16, 1969, attended by approximately 500 representatives of the fishing industry. Tentative proposals for regulating the 1970 fishery were released subject to further consideration by members of the industry and their representatives on the Commission's Advisory Committee.

1969 REGULATIONS

Recommendations for regulations governing the 1969 sockeye and pink salmon fishery in Convention waters were adopted at a meeting of the Commission held on January 17, 1969 and submitted to the two national governments for approval and to the State of Washington for implementation on February 13, 1969. The recommendations for Canadian Convention waters were implemented by the Government of Canada by an Order-in-Council dated June 25, 1969 and for United States Convention waters by an Order of the Director of the Washington State Department of Fisheries on April 17, 1969.

The recommendations of the Commission were as follows:

Canadian Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends that regulations to the following effect, in the interests of such fisheries, be adopted by Order-in-Council as amendments to the Special Fishery Regulations for British Columbia for the season of 1969 under authority of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in that portion of Area 20 lying westerly of a straight line drawn true south from Sheringham Point lighthouse to the International Boundary line with purse seines:

(a) From the 6th day of July, 1969, to the 26th day of July, 1969, both dates inclusive; and

(b) From the 27th day of July, 1969, to the 2nd day of August, 1969, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday and Tuesday; and

(c) From the 3rd day of August, 1969, to the 30th day of August, 1969, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(d) From the 31st day of August, 1969, to the 20th day of September, 1969, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 6th day of July, 1969, to the 26th day of July, 1969, both dates inclusive; and

(b) From the 27th day of July, 1969, to the 2nd day of August, 1969, both dates inclusive, except from

(i) six o'clock in the afternoon of Monday to six o'clock in the forenoon of of Tuesday; and

(ii) six o'clock in the afternoon of Tuesday to six o'clock in the forenoon of Wednesday; and

(c) From the 3rd day of August, 1969, to the 30th day of August, 1969, both dates inclusive, except from

(i) six o'clock in the afternoon of Monday to six o'clock in the forenoon of Tuesday; and

(ii) six o'clock in the afternoon of Tuesday to six o'clock in the forenoon of Wednesday; and

(iii) six o'clock in the afternoon of Wednesday to six o'clock in the forenoon of Thursday of each week; and

(d) From the 31st day of August, 1969, to the 20th day of September, 1969, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to seven o'clock in the forenoon of Wednesday; and

(iii) seven o'clock in the afternoon of Wednesday to seven o'clock in the forenoon of Thursday of each week.

(3) No person shall fish for sockeye or pink salmon with hook and line or trolling gear in the waters described in subsection (1) of this section except for the purpose of personal consumption and not for sale or barter between midnight Friday and midnight the Sunday following of each week from the 10th day of August, 1969, to the 13th day of September, 1969, both dates inclusive.

2. No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Areas 17 and 18 and in the waters of District No. 1 by means of nets:

(a) From the 26th day of June, 1969, to the 12th day of July, 1969, both dates inclusive; except for those sockeye or pink salmon taken in gill nets having mesh of not less than 8½ inches extension measure as authorized for the taking of chinook salmon by the Director of Fisheries for the Pacific Region and pursuant to the provisions of the British Columbia Fishery Regulations, and

(b) From the 13th day of July, 1969, to the 19th day of July, 1969, both dates inclusive, except from eight o'clock in the forenoon of Wednesday to eight o'clock in the forenoon of Thursday; and

(c) From the 20th day of July, 1969, to the 9th day of August, 1969, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday of each week; and

(d) From the 10th day of August, 1969, to the 13th day of September, 1969, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(e) From the 14th day of September, 1969, to the 20th day of September, 1969, both dates inclusive; and

(f) From the 21st day of September, 1969, to the 11th day of October, 1969, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week.

3. No person shall fish for sockeye or pink salmon, except by angling or trolling for the purpose of personal consumption and not for sale or barter, in the Convention waters of Canada (the waters of Howe Sound excepted) lying easterly and inside of a straight line projected from Gower Point at the westerly entrance to Howe Sound to Thrasher

Rock light, thence in a straight line to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence in a straight line towards Point Roberts light to the intersection with the International Boundary line, thence following the International Boundary line to its intersection with the mainland from the 17th day of August, 1969, to the 27th day of September, 1969, both dates inclusive, except at the times that net fishing other than with chinook salmon nets may be permitted within that area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Director of Fisheries of the State of Washington that regulations to the following effect, in the interests of such fisheries, be adopted by him for the year 1969 by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines:

(a) From the 6th day of July, 1969, to the 26th day of July, 1969, both dates inclusive; and

(b) From the 27th day of July, 1969, to the 2nd day of August, 1969, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday; and

(c) From the third day of August, 1969, to the 16th day of August, 1969, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(d) From the 17th day of August, 1969, to the 20th day of September, 1969, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 6th day of July, 1969, to the 26th day of July, 1969, both dates inclusive; and

(b) From the 27th day of July, 1969, to the 2nd day of August, 1969, both dates inclusive, except from seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday and from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(c) From the 3rd day of August, 1969, to the 9th day of August, 1969, both dates inclusive, except from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday, from seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday and from seven o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday; and

(d) From the 10th day of August, 1969, to the 16th day of August, 1969, both dates inclusive, except from seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday, from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday and from seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday; and

(e) From the 17th day of August, 1969, to the 23rd day of August, 1969, from the 31st day of August, 1969, to the 6th day of September, 1969, and from the 14th day of September, 1969, to the 20th day of September, 1969, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday, from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday and from six o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week; and

(f) From the 24th day of August, 1969, to the 30th day of August, 1969, and from the 7th day of September, 1969, to the 18th day of September, 1969, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday, from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday and from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with commercial trolling gear from the 10th day of August, 1969, to the 13th day of September, 1969, both dates inclusive, except from midnight Sunday to midnight Friday of each week.

2. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia from the 26th day of June, 1969, to the 12th day of July, 1969, both dates inclusive, except in those waters lying southerly of a line projected from Dungeness light to Smith Island light to Lawson Reef light to Langley Point on Fidalgo Island which will remain under regulation by the Washington State Director of Fisheries.

3. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines:

(a) From the 13th day of July, 1969, to the 19th day of July, 1969, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday; and

(b) From the 20th day of July, 1969, to the 16th day of August, 1969, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(c) From the 17th day of August, 1969, to the 27th day of September, 1969, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with reef nets:

(a) From the 13th day of July, 1969, to the 19th day of July, 1969, both dates inclusive, except from

(i) twelve o'clock (noon) Sunday to half past nine o'clock in the afternoon of Sunday; and

(ii) half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday; and

(iii) half past five o'clock in the forenoon of Tuesday to twelve o'clock (noon) Tuesday; and

(b) From the 20th day of July, 1969, to the 16th day of August, 1969, both dates inclusive, except from

(i) twelve o'clock (noon) Sunday to half past nine o'clock in the afternoon of Sunday; and

(ii) half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday; and

(iii) half past five o'clock in the forenoon of Wednesday to twelve o'clock (noon) Wednesday of each week; and

(c) From the 17th day of August, 1969, to the 27th day of September, 1969, both dates inclusive, except from

(i) twelve o'clock (noon) Sunday to nine o'clock in the afternoon of Sunday; and

(ii) five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday; and

(iii) five o'clock in the forenoon of Wednesday to twelve o'clock (noon) Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 13th day of July, 1969, to the 19th day of July, 1969, both dates inclusive, except from seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday and from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(b) From the 20th day of July, 1969, to the 26th day of July, 1969, and from the 3rd day of August, 1969, to the 9th day of August, 1969, all dates inclusive, except from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday, from seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday and from seven o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week; and

(c) From the 27th day of July, 1969, to the 2nd day of August, 1969, and from the 10th day of August, 1969, to the 16th day of August, 1969, all dates inclusive, except from seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday, from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday and from seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week; and

(d) From the 17th day of August, 1969, to the 23rd day of August, 1969, from the 31st day of August, 1969, to the 6th day of September, 1969, and from the 14th day of September, 1969, to the 20th day of September, 1969, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday, from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday and from six o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week; and

(e) From the 24th day of August, 1969, to the 30th day of August, 1969, from the 7th day of September, 1969, to the 13th day of September, 1969, and from the 21st day of September, 1969, to the 27th day of September, 1969, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday, from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday, and from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

4. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying southerly of a line projected from Dungeness light to Smith Island light to Lawson Reef light to Langley Point on Fidalgo Island from the 10th day of August, 1969, to the 13th day of September, 1969, both dates inclusive, except with nets having a mesh of not less than 8 inches extension measure and under regulation by the Washington State Director of Fisheries.

5. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying northerly and westerly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the flashing white light on Georgina Point at the entrance to Active Pass in the Province of British Columbia from the 24th day of August, 1969, to the 6th day of September, 1969, and from the 14th day of September, 1969, to the 27th day of September, 1969, all dates inclusive.

6. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn true south from the southeast tip of Point Roberts in the State of Washington (otherwise known as Lily Point) to the International Boundary line from the 7th day of September, 1969, to the 13th day of September, 1969, both dates inclusive.

7. (1) The foregoing recommended regulations shall not apply to the following United States Convention waters:

(a) State Fishing Area No. 7 including all Convention waters known as Bellingham Bay lying inside of a line extending from Point Frances through the Post Point bell buoy to the mainland, and

(b) That portion of State Fishing Area No. 3 lying easterly and inside of a line projected from Carter Point on Lummi Island to the most northerly tip of Vendovi Island, thence to Clark Point on Guemes Island including the waters of Samish Bay, and

(c) Preserves previously established by the Director of Fisheries of the State of Washington for the protection of other species of food fish.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

Emergency Amendments

In order to provide for adequate racial escapements of Fraser River sockeye and pink salmon and for an equitable share of the season's catch by the fishermen of Canada and the United States, the approved regulations as detailed above were later amended on recommendation of the Commission. A detailed list of the regulatory amendments is as follows:

July 10, 1969—Due to a favorable escapement of Early Stuart sockeye, the Commission recommended that fishing for 24 hours in Areas 17 and 18 and District No. 1 of Canadian Convention waters be advanced to commence at 8:00 a.m. Monday, July 14 instead of the scheduled opening of 8:00 a.m. Wednesday, July 16.

July 25, 1969—In the interest of equalizing the catch of sockeye between the fishermen of the two countries the Commission recommended opening Canadian Convention waters of District No. 1 and Areas 17 and 18 to fishing 20 hours earlier than originally scheduled with fishing to commence at 12:00 noon Sunday, July 27.

July 28, 1969—In the interest of equitable division of the catch, the Commission recommended extending the fishing time in Canadian Convention waters lying westerly of the Angeles Point-William Head line by 24 hours during the current week for

a total of three days fishing. The Commission also recommended that the scheduled fishing time in United States Convention waters lying easterly of the Angeles Point-William Head line for the current week be reduced by 24 hours to two days fishing.

July 29, 1969—In view of the current strong showing of sockeye at the entrance of Juan de Fuca Strait and in the San Juan Islands area of Convention waters, the Commission reconsidered its regulatory recommendations made on July 28, 1969. The Commission recommended that fishing time in United States Convention waters lying easterly of the Angeles Point-William Head line for the current week be restored to three days fishing as originally scheduled. Also, in the interest of equal division of the catch, the Commission recommended increasing fishing time in Canadian Convention waters lying westerly of the Angeles Point-William Head line by a further 24 hours making four days fishing for the current week.

August 1, 1969—In order to achieve better division of the sockeye catch, the Commission recommended that fishing time in all United States Convention waters be advanced 24 hours earlier than originally scheduled and open for reef nets at 12:00 noon Saturday, August 2. To provide adequate Horsefly and Late Stuart sockeye for escapement, the Commission recommended delaying the scheduled opening for Canadian Convention waters lying easterly of the Angeles Point-William Head line for the week commencing August 3.

August 4, 1969—Due to the continued abundance of Horsefly and Late Stuart sockeye approaching the Fraser River, the Commission recommended that Canadian Convention waters of District No. 1 and Areas 17 and 18 be opened to fishing at 6:00 p.m. Monday, August 4 with the closure to fishing to start at the originally scheduled time of 8:00 a.m. Wednesday, August 6.

August 8, 1969—In the interest of obtaining additional escapement to the Horsefly and Late Stuart spawning areas, the Commission recommended that the scheduled fishing period of 24 hours for Canadian Convention waters lying easterly of the Angeles Point-William Head line be delayed 24 hours and start at 8:00 a.m. Tuesday, August 12.

August 12, 1969—To achieve closer division of the sockeye catch, the Commission recommended an additional 24 hours of fishing in all United States Convention waters making four days fishing for the current week.

August 14, 1969—To protect the smaller-than-anticipated numbers of early Fraser pink salmon and late run sockeye currently delaying off the mouth of the Fraser River, the Commission recommended that fishing time in Canadian Convention waters lying easterly of the Angeles Point-William Head line be permitted for 12 hours commencing at 6:00 a.m. Wednesday, August 20, but only in those waters lying inside and easterly of a straight line drawn from Point Grey in a southerly direction to the westerly end of the North Arm jetty, thence to the Sand Heads light, thence to the Canos Pass buoy, thence to a light on the westerly end of Tsawwassen causeway and thence to where a straight line projected through West Point Roberts light intersects the International Boundary, commonly known as the "Blue Line." The Commission also recommended a 24-hour reduction in fishing time in Canadian Convention waters lying westerly of the Angeles Point-William Head line from that originally scheduled for the week commencing August 17, because of the light showing of Fraser River pink salmon. For the same reason, a 24-hour reduction in fishing time was recommended in all United States Convention waters for the week commencing August 17.

August 21, 1969—In view of the current small pink salmon catches and uncertainty concerning the exact size of the run, the Commission recommended delaying the scheduled opening of Canadian Convention waters lying westerly of the Angeles Point-William Head line for the week commencing August 24. In addition, the Commission recommended reducing the fishing time in all open United States Convention waters lying easterly of the Angeles Point-William Head line to two days for the week commencing August 24. In Canadian Convention waters lying easterly of the Angeles Point-William Head line, the Commission recommended 12 hours fishing, starting at 8:00 a.m. Tuesday, August 26, in only those waters lying inside and easterly of the "Blue Line."

August 27, 1969—In order to further assess the abundance of the Fraser River pink salmon run, and assist in division of the catch, the Commission recommended that fishing be permitted for 48 hours in Canadian Convention waters lying westerly of the Angeles Point-William Head line commencing Saturday, August 30, but that all United States Convention waters remain closed through August 31. In addition, the Commission recommended a fishing closure in Canadian Convention waters lying easterly of the Angeles Point-William Head line for the week commencing August 31 in order to protect delaying pink salmon in the waters off the mouth of the Fraser River. The Department of Fisheries of Canada opened the

waters lying easterly and inside of the "Blue Line" to fishing with 9½ inch mesh nets for 12 hours effective 8:00 a.m. Tuesday, September 2, to permit a reasonable exploitation of current chinook salmon runs.

August 31, 1969—In the interest of division of the pink salmon catch, the Commission recommended two additional days of fishing in Canadian Convention waters lying westerly of the Angeles Point-William Head line commencing on Monday, September 1, for a total of four days fishing during the current period. The Commission also recommended that 48 hours of fishing be granted in United States waters lying easterly of the Angeles Point-William Head line not otherwise closed to fishing, with reef nets commencing at 12:00 noon, Monday, September 1. To protect pink salmon destined for Washington State streams, the Commission recommended closure of United States Convention waters lying westerly of the Angeles Point-William Head line for the current week. Also, to protect delaying pink salmon, the waters lying westerly of a line projected from Lily Point on East Point Roberts true south to the International Boundary were closed.

September 4, 1969—To protect delaying pink salmon in Georgia Strait available for escapement, the Commission recommended closure of all Canadian Convention waters lying easterly of the Angeles Point-William Head line, except for a 12-hour fishing period commencing Sunday, September 7 at 8:00 p.m. in the waters lying westerly, southerly and outside the "Blue Line." Due to a delayed migration and excessive pink salmon catch in United States Convention waters, the Commission recommended continued closure of United States Convention waters lying easterly of the Angeles Point-William Head line. The Commission also recommended that United States Convention waters lying westerly of the Angeles Point-William Head line open as originally scheduled effective Sunday, September 7. In addition, the Commission recommended opening Canadian Convention waters lying westerly of the Angeles Point-William Head line 24 hours in advance, effective Sunday, September 7, for three days fishing. The Commission also recommended closing all Canadian Convention waters lying easterly of the Angeles Point-William Head line for the week commencing September 7, except in the above referenced waters lying outside, westerly and southerly of the "Blue Line" for 12 hours fishing commencing at 8:00 p.m. Sunday, September 7, for the purpose of assessing the number of early run pink salmon available for escapement.

September 8, 1969—In view of the improved showing of pink salmon in all Convention waters, the Commission recommended that all United States Convention waters lying easterly of the Angeles

Point-William Head line not previously closed (West Beach and waters west of the Lily Point line), be opened to fishing for 48 hours commencing with reef nets at 12:00 noon Tuesday, September 9. The Commission also recommended adding 24 hours fishing time in all Convention waters lying westerly of the Angeles Point-William Head line, making four days fishing for the current week. An additional verification of the numbers of pink salmon available for escapement in Georgia Strait was needed, therefore the Commission recommended that fishing be permitted in that portion of Canadian Convention waters easterly of the Angeles Point-William Head line lying outside, westerly and southerly of the "Blue Line" for 12 hours effective 8:00 p.m. Thursday, September 11.

September 12, 1969—Due to the decline of the pink salmon run at the entrance to Juan de Fuca Strait, the Commission recommended that regulatory control of all Convention waters lying westerly of the Angeles Point-William Head line be relinquished effective Sunday, September 14. In addition, the Commission recommended that all United States Convention waters lying easterly of the Angeles Point-William Head line, except the waters lying westerly of the Lily Point line, be opened to fishing for 48 hours commencing for reef nets at 12:00 noon Sunday, September 14. To protect pink salmon delaying in Georgia Strait, the Commission recommended closing all Canadian Convention waters lying easterly of the Angeles Point-William Head line from Sunday, September 14 to Sunday, September 28, except during the week commencing Sunday, September 21 when chinook salmon fishing with 9½ inch mesh may be permitted under authorization by the Regional Director of the Department of Fisheries of Canada in that portion of District No. 1 lying above the Brunswick Cannery-Oak Street Bridge line.

September 16, 1969—Due to the reduction in catch of pink salmon in United States Convention waters, the Commission recommended that control of all remaining United States Convention waters be relinquished commencing Sunday, September 21, except the waters lying westerly and northerly of the Iwersen's dock-Active Pass line. Also, on this date, the Department of Fisheries of Canada announced that fishing for chinook salmon would be permitted with 9½ inch mesh in the Fraser River above the Brunswick Cannery-Oak Street Bridge line for 12 hours commencing at 7:00 a.m. Wednesday, September 24.

September 25, 1969—In the interest of escapement and division of the pink salmon catch, the Commission recommended closure of all Canadian Convention waters lying easterly of the Angeles Point-William Head line for the week commencing Sunday,

September 28, except those waters of the Fraser River lying upstream from the Oak Street Bridge-No. 6 Buoy line (i.e., one mile below the Brunswick Cannery line) which could be open to chinook salmon net fishing with 9½ inch mesh. The above referenced waters were opened by the Department of Fisheries of Canada to 9½ inch mesh nets for exploitation of chinook salmon for 12 hours effective 7:00 a.m. Wednesday, October 1.

October 2, 1969—In view of the indicated satisfactory pink salmon escapement, the Commission recommended 24 hours fishing in all Canadian Convention waters lying easterly of the Angeles Point-William Head line effective at 8:00 a.m. Wednesday, October 8.

The Commission relinquished control of all remaining Canadian Convention waters effective Sunday, October 12, thus completing the Commission's regulatory obligations in Convention waters for the 1969 season.

SOCKEYE SALMON REPORT

The Fishery

The 1969 run of Fraser River sockeye in Convention waters totaled 4,440,000 fish, of which 3,261,712 were caught commercially, 158,744 were taken by the Indian fishery and 1,019,544 were recorded on the spawning grounds (see Tables I to VI in Appendix). This cycle year catch was the third largest since 1917 (Table II), and was supported substantially by the Horsefly River population which approximated 1,500,000 sockeye in spite of a prespawning mortality of 46.8% in the 1965 brood year escapement. The Horsefly River sockeye population was the largest since 1917, indicating the tremendous potential of this area for rehabilitation once the prespawning loss can be prevented. If all of the brood escapement had spawned in 1965, the 1969 Horsefly run would theoretically have approached 3,000,000 fish. Details of this problem and its current status are presented later in a specific section on prespawning mortality.

Of the total 1969 Fraser River sockeye run, estimated at 4,978,000, the percentage approaching the river from the north declined, as expected, for the third successive year. An estimated 465,000 Fraser River sockeye were taken in Johnstone Strait, representing 12.24% of the total catch in all waters and only 9.34% of the total run.

Canadian fishermen caught 1,675,536 sockeye and United States fishermen caught 1,586,176 for a total of 3,261,712—sharing the catch on a basis of 51.37% and 48.63% respectively. The surplus catch favoring Canadian fishermen offsets considerably the unavoidable 1967 surplus in catch by United States fishermen when substantial runs of both sockeye and pink salmon occurred in the fishery at the same time. Division of the total catch since 1946, when the Commission started

regulating the fishery to divide the allowable catch as equitably as possible, stands at 50.47% for the United States and 49.53% for Canada. More than the noted difference in the total accumulated catch since 1946 was caused by the occurrence of several price disputes in the Canadian fishery.

The average weight of *four-year-old* sockeye in 1969 was 5.69 pounds, approximating the cycle average weight of 5.65 pounds.

The percentage of the total Canadian Convention waters sockeye catch taken in Juan de Fuca Strait and the high seas increased substantially in 1969 to 41.16% compared with only 16.73% in the 1965 cycle year. In spite of an unusual influx of small purse seines from other areas, the gill net catch in the Strait almost equaled that of the purse seines. The Canadian troll catch of 66,824 sockeye in Convention waters reflects the increasing capabilities of this fishery and the interest of the troll fishermen in harvesting Fraser River sockeye. As new gear is developed for operating in new areas, the result is a smaller share of the allowable catch remaining available in the earlier established fishing areas.

Per Cent of Canadian Sockeye Catch Taken in the High Seas and Juan de Fuca Strait		*Per Cent of Canadian Sockeye Catch Taken by Purse Seines in Juan de Fuca Strait**		*Per Cent of Canadian Sockeye Catch Taken by Gill Nets in Juan de Fuca Strait**	
Cycle Year	*Per Cent*	*Maximum P.S. Units*	*Per Cent*	*Maximum G.N. Units*	*Per Cent*
1969	41.16	149	19.83	281	19.22
1968	10.10	31	1.56	138	4.78
1967	52.96	102	34.84	341	15.08
1966	53.24	77	30.53	287	22.00
1965	16.73	89	8.30	238	7.72

* Troll catches not listed.

Distribution of the sockeye catch by gear in United States Convention waters was not unusual except that the share taken by the gill net fleet increased, mainly because of an increased number of boats, from 23.01% in 1965 to 32.64% in 1969. However, the increased share taken by this gear is still below that of the 34.20% recorded in the cycle year of 1961. In spite of a Sunday noon opening during the entire season, the share of the catch taken by reef nets remained at the same low level of 4.84% established in the brood year of 1965.

Escapement

The net escapement of 1,019,544 sockeye represented 23.0% of the 1969 run to Convention waters and 20.5% of the calculated total Fraser River run, increasing 20.6% over that of the brood year (Table VI). Generally, the escapement of individual populations was satisfactory although special note should be made in respect to certain areas.

The Early Stuart sockeye run was exceptionally large in 1969 considering the recorded escapement of only 23,045 fish in the brood year. The total 1969 escapement of 125,662 fish represents more than a fivefold increase over that of 1965. The large escapement, resulting from extended closures in the commercial fishery, restriction of the Indian fishery, and favorable water levels in the Fraser River during upstream migration, provides the potential for a substantial catch in 1973.

Increased fishing time granted to reduce the early part of the Chilko and Horsefly escapements resulted in a substantial percentage of the concurrent runs to Upper Pitt River and Gates Creek being taken in the commercial fishery. In spite of this heavy fishing mortality, the escapement to Upper Pitt River increased substantially over that of the brood year because of the large number of sockeye produced by the artificial incubation channel. In contrast, at Gates Creek where returns from the new artificial spawning channel are not expected until 1972, the escapement declined 47.5%. The same situation existed in 1968 with Upper Pitt having an increased escapement over that of the brood year while the escapement to Gates Creek declined.

Gradual disappearance of the relatively small sockeye runs to Nithi River, Endako River and Ormonde Creek in the Francois-Fraser Lake district continued to cause concern in 1969. All of these streams flow through lengthy willow swamps, with very difficult access for inspection, and are particularly suited to the construction of dams by expanding beaver populations which currently are not controlled. Through the Department of Fisheries and Forestry of Canada, arrangements have been made with the Provincial Government to control the beaver populations in these watersheds in the hope that sufficient fish remain, which may not have been observed in some cases, to restore these populations. It should be noted that these fish pass through the fishery mixed with much larger populations which must be harvested. Special regulatory control, to increase the escapement of the endangered populations, is therefore impractical. There is concern also over a serious decline in the small run to Big Silver Creek, tributary to Harrison Lake. In this case, watershed deterioration is believed to be responsible for the declining sockeye population. Since few fish are now left in Big Silver Creek, it is essential that Weaver Creek, with its artificial spawning channel, and Birkenhead River produce enough sockeye fry to utilize the rearing capacity of Harrison Lake.

Escapements to Horsefly River and Late Stuart spawning grounds were slightly below those required to maintain future production at the 1969 level, particularly in view of the prespawning mortality of Horsefly fish, to be discussed later in this report. The dangers inherent in an intense and efficient fishery extending over a wide area were evident during passage of the Horsefly and Late Stuart runs. Large numbers of sockeye destined for these streams passed through United States Convention waters during the weekly closed period from July 24 to July 27 inclusive, much to the disappointment of United States fishermen. To prevent excessive escapement, the Fraser River fishery was opened at 12:00 noon Sunday, July 27 instead of 8:00 a.m. the following Monday. In the 20 hours of earlier fishing time, Fraser River gillnetters harvested 359,000 sockeye, the largest single day's

catch in recent history. Thus the difference between overfishing and a satisfactory escapement to Horsefly and Late Stuart is represented by approximately 100,000 sockeye, only 27% of the catch taken during less than a single day in one of several major fishing areas.

Satsifactory escapements were recorded for all other areas, with desired increases over those of the brood year noted at Cultus Lake, Birkenhead, Seymour, Chilko, Nadina, Stellako and the Bowron Rivers. The escapements to Weaver and Scotch Creeks were the largest ever recorded in any cycle year.

Prespawning Mortality

For a number of years the Commission has been concerned over a certain percentage of adult sockeye salmon that, after successfully reaching their spawning grounds, die before completing the spawning act. Heavy losses have occurred at various spawning grounds in warm years; however, even more alarming have been the recent significant mortalities among populations spawning in normal water temperatures.

A review of the prespawning mortalities of sockeye over the past 23 years, combined with pathological and morphological examination of dying fish in the years since 1961, has allowed a gross classification of such deaths into three general categories:

1. Those mortalities associated with high water temperatures and the occurrence of *Chondrococcus columnaris*.

2. Those mortalities associated with normal water temperatures and the occurrence of bacterial gill infection.

3. Those mortalities among early arrivals on the spawning grounds which may be related to failure of the normal maturation processes.

Prespawning mortality has cost the fishing industry millions of dollars through a failure of the escapement to realize its full potential, and has restricted the degree of rehabilitation of such populations as the one spawning in the Horsefly-McKinley system. Research in this area in 1965 revealed that a reduction in water temperature would create a suitable environment to prevent development of columnaris infection. On the basis of these data, the McKinley Creek temperature control project was built and placed in operation in time for the 1969 run to serve as a practical prototype experiment using temperature control to reduce mortalities from columnaris.

Water temperatures were normal throughout the Fraser River watershed in 1969 with the result that although fish contacted columnaris bacteria while migrating up the Fraser River, the disease failed to develop in the cooler waters

FIGURE 1—McKinley Lake temperature control structure. The warm surface flow is shut off prior to and during spawning. The creek flow during the shut off period is drawn by pipe from lower cool levels of the lake and discharged through a fishway at left side of picture. At all other times the outflow of the lake is unrestricted.

of the spawning grounds. Columnaris lesions tended to heal, justifying the findings of the previous research program. None of the dead fish examined in 1969 appeared to be suffering from advanced columnaris infection. However, water temperatures on McKinley Creek (tributary to Horsefly River) would have approached those required for a major outbreak if the prevailing water temperature had not been artificially reduced by the temperature control structure.

In spite of ideal spawning temperatures which controlled the development of columnaris, and an extremely healthy looking spawning population, large numbers of unspawned fish were recovered on the Horsefly River and McKinley Creek spawning grounds in 1969. It is estimated that the prespawning mortality approached 50% of the total Horsefly-McKinley escapement.

The overall appearance of the 1969 Horsefly spawning population was in direct contrast to that observed during the severe columnaris outbreaks in 1961 and 1965 when large numbers of fish became lethargic and showed no interest in nest digging or pairing. In 1969 the fish appeared clean and unmarked, spread well over the spawning grounds and showed signs of active nest digging. However, evidence of severe gill pathology and positive response to oxygen therapy indicated that the 1969 Horsefly escapement suffered from a virulent outbreak of bacterial gill disease. This disease is common in hatchery fish, and outbreaks occur frequently at normal water temperatures.

It is now evident that columnaris can be controlled through the artificial control of water temperatures on the Horsefly system. It is also apparent that the control of columnaris will not necessarily reduce the prespawning mortality of the Horsefly escapement in those years when bacterial gill disease is operative in the spawning area, and additional measures must be taken to prevent prespawning loss.

Until recently, chemical therapy has been impossible since all chemicals known to be effective and practical for controlling both columnaris and bacterial gill disease have contained a mercuric base, making them unacceptable from a public health standpoint. However, in recent years information has been obtained through the U.S. Fish and Wildlife Service of a nitrofuran drug developed in Japan. Preliminary tests indicate it may have a great potential for controlling myxobacteria, including those causing both of the referenced fish diseases. No adverse side-effects resulting from the use of this drug have been noted, although its total effect on stream and lake ecology has not as yet been measured. The Commission intends to start at once conducting its share of the necessary experiments to determine if this drug can safely be released by the Pure Food and Drug Administrations of the two countries concerned, for large-scale disease treatment. The required experiments should be completed by 1971, well in advance of the return run to the Horsefly River in 1973.

Since both columnaris and bacterial gill infection occur generally under adverse environmental conditions for fish, it has been suggested that pollution in the Fraser River may be the contributing cause for the more frequent and wide-

spread occurrence of prespawning mortality in recent years. In this connection it should be noted that several escapements including the Late Stuart and Late Nadina populations migrated upstream at the same time as the Horsefly run in 1969, and for a much longer distance, yet suffered little or no mortality. It is true that logging and land clearing, which cause increased water temperature, increase the possibility of columnaris disease outbreaks, but there is as yet no evidence that pollution of the Fraser River is contributing to the problem.

Observations are being made to isolate the number of fish dying from a failure of the normal maturation processes, rather than from disease. This task is most difficult since these two possible causes of death may be interrelated. Where disease is not in evidence, the total mortality of unspawned adult sockeye is usually less than 10%.

Rehabilitation

The Commisson's sockeye rehabilitation program utilizing spawning and incubation channels has met with considerable success, as described in the Introduction. Production from the present channels is detailed in the following section.

The Weaver Creek spawning channel was placed in operation for the first time in 1965, the brood year which produced the 1969 sockeye population. In 1965 a total of 11,162 sockeye entered the creek and 4,400 of this total, including 2,986 females, spawned in the new channel. After adjustment for spawning success, egg deposition from the 2,871 "effective" female spawners in the channel was calculated to be 11,463,000, and 7,845,000 fry emerged the following spring for an egg-to-fry survival rate of 68.4%. This survival rate was about nine times the average survival rate of 7.6% observed for naturally deposited eggs in Weaver Creek over the 8-year period from 1951 to 1959.

In the return year of 1969, the total Weaver Creek run was 169,000 sockeye, based on a preliminary estimate of the catch determined from scale analyses. On the basis of the relative fry output from the creek and channel, it is estimated that the channel produced 140,000 of the total Weaver Creek run of 169,000 sockeye, representing a yield of about 49 adults per effective female spawner, or almost a sixfold increase over the creek production.

At Upper Pitt River, the complete incubation station with gravel incubation area has been in operation since 1963. Returns of four- and five-year-old sockeye have now been obtained from two brood years, 1963 and 1964, produced from both the incubation channel and the river system. In the 11 years prior to 1963, the average yield of adult sockeye was 6.8 per effective female spawner. In contrast, the yield from the 1963 brood produced in the channel was 92.0 adults per effective female spawner, and that from the 1964 brood was 103 adults per effective female spawner.

Listed below are the survival rates recorded in all sockeye spawning and incubation channels now in operation in the Fraser River system, including the first records from the new spawning channel at Gates Creek.

Salmon Production at Weaver Creek Channel

Brood Year and Species	*Total Escapement to Creek and Channel*	*Channel Only*				
		Spawning Population	*Female Spawners*	*Egg Deposition*	*Fry Produced*	*Per Cent Survival*
1965						
Sockeye	11,162	4,436	2,986	11,463,000	7,845,000	68.4
Pinks	528	50	32	63,000	43,000	
Chum	—	1,186	487		982,000	
1966						
Sockeye	20,416	6,541	3,424	13,120,000	10,758,000	82.0
Pinks	0	0	0	0	0	
Chum	—	170	92		227,000	
1967						
Sockeye	22,617	2,887	1,631	5,793,000	4,501,000	77.7
Pinks	909	123	70	140,000	109,000	
Chum	—	464	202		471,000	
1968						
Sockeye	4,516	1,910	784	2,971,000	2,559,000	86.1
Pinks	0	0	0	0	0	
Chum	—	2,503	1,138		2,703,000	
1969						
Sockeye	58,922	17,089	9,671	36,453,000		
Pinks	725	227	108	211,000		
Chum	—	2,365	1,286			

Sockeye Production at Upper Pitt River Hatchery and Incubation Area

Brood Year	*Total River Escapement*	*Incubation Location*	*Eggs Spawned*	*Fry Produced*	*Per Cent Survival*
1963	12,680	Hatchery, Incubation Area	3,189,000	2,417,000	75.8
1964	13,804	" " "	3,700,000	3,256,000	88.0
1965	6,981	" " "	2,133,000	1,776,000	83.3
1966	20,867	" " "	3,658,000	2,868,000	78.4
1967	10,300	" " "	4,529,000	3,300,000	72.9
1968	16,988	" " "	3,163,000	2,673,000	84.5
1969	24,905	" " "	4,881,000		

Sockeye Production at Gates Creek Channel

Brood Year	Total Escapement to Creek and Channel	Channel Only				
		Spawning Population	Female Spawners	Egg Deposition	Fry Produced	Per Cent Survival
1968	10,289	6,284	3,572	7,920,000	6,971,000	88.0
1969	881	676	388	919,000		

Based on the success of adult sockeye production from these channels, the Commission considers a sound basis has been established for constructing additional facilities to expand the runs of Fraser River sockeye salmon. In certain cases, the new facilities may be required to protect runs where the natural environment is deteriorating because of encroaching civilization, but in other areas channels can be used to increase sockeye production from rearing lakes now only partially utilized.

One distinctive requirement for production of sockeye salmon is a lake rearing area in which the fry feed on zooplankton and grow for one year before migrating to the sea as smolts. The Fraser system includes more than 15 sockeye rearing lakes, and many of these are at present grossly underutilized. The area of each lake, in conjunction with the concentration of plankton available, gives an index of its potential rearing capacity for sockeye. This index does not take into account some factors such as length of growing season, but is supported by measured growth rates of present juvenile sockeye populations, and by the estimated size of sockeye runs up to 1913. It is considered to be a usable measure of sockeye rearing capacity. The geographic distribution of this index of rearing capacity is given in the following table, together with estimates of the rearing capacity not utilized by offspring of even the largest spawning runs in the period from 1945 to 1968. These figures show that there is a rearing capacity index of at least 330,884 still unused, or about 55% of the total. Approximately 90% of this unused rearing capacity is in the lakes upstream from Lytton.

Region	Total Rearing Capacity		Estimated Unused Rearing Capacity	
	Index	Per Cent of Total	Index	Per Cent of Total
Below Hope	29,900	5.0	6,825	2.1
Thompson River	155,300	25.9	25,483	7.7
Fraser Above Lytton	415,100	69.1	298,576	90.2
Total	600,300	100.0	330,884	100.0

In the northern part of the Fraser River system, Francois, Stuart, Takla and Quesnel Lakes comprise the major underutilized lake rearing areas, with a total rearing capacity index of 310,700. Only 12% of this capacity has been utilized by the maximum recent populations. This large rearing capacity, considered capable of producing a dominant cycle catch of 24 million sockeye, offers prospect for tremendous expansion of Fraser River sockeye runs through application of the new fish-culture methods.

At Nadina River, tributary to Francois Lake, the Commission has approved the construction of a spawning channel for sockeye salmon, starting in 1970. The channel will provide additional spawning area to increase fry production from the Late Nadina run which spawns in a very small area below the falls at the outlet of Nadina Lake. The rearing potential of Francois Lake is only 4% utilized by the largest recent runs of sockeye, principally the Early and Late runs to Nadina River. Environmental conditions are most favorable for the Late Nadina run, and consequently this stock has been selected for expansion. The proposed spawning channel will be 9,800 feet long and will accommodate 14,450 female sockeye spawners. At full design capacity, it will produce about 24 million fry and increase utilization of Francois Lake to 17%.

The lakes in the Stuart River system contain 53% of the unused sockeye lake rearing capacity in the Fraser River system, and at present only Trembleur Lake is utilized to any extent by portions of the Early and Late Stuart runs. At Stuart Lake, the maximum Late Stuart sockeye runs to Tachie River, Kuzkwa and Pinchi Creeks have only utilized about 8% of the calculated rearing capacity. Production in this lake appears to be limited by availability of spawning ground, and investigations are under way to locate a suitable site for a spawning channel to expand the production of Late Stuart sockeye in Stuart Lake. The spawning environment in the Takla Lake system appears to be suitable only for the Early Stuart run, and the maximum populations utilize about 18% of the rearing capacity. There is a large spawning area available in the Driftwood River for expansion of this population, thus no proposals to increase the spawning grounds at Takla Lake are contemplated at present.

The Commission's efforts to restore the sockeye runs to Horsefly River, which contains the principal spawning grounds tributary to Quesnel Lake, have been an outstanding success. Sockeye escapements to the Horsefly River have increased from 1,065 fish in 1941 to 359,000 in 1965, six cycles later. However, much of the spawning ground available in the lower part of Horsefly River appears unsuitable for this run, because the timing of this residual segment of the historical run is not synchronized with favorable water temperatures in the lower areas. Greater utilization of Quesnel Lake will require expansion of the existing stock in a location with a suitable spawning environment. A spawning channel adjacent to the existing spawning grounds in Horsefly River or McKinley Creek could be used for this purpose, but plans in this regard await the findings of current investigations concerning the frequent prespawning mortality of Horsefly River sockeye.

In the Thompson River system, the rearing areas in Adams, Kamloops and Mabel Lakes are only partially utilized by the existing sockeye runs. These lakes have a combined rearing capacity slightly greater than Quesnel Lake, but this

capacity is only about 1.5% utilized by present runs. In Adams Lake, the original sockeye run was destroyed by the former logging dam at the lake outlet, and restoration of this run has not yet been successful as it involves transplant of a suitable donor stock. Thus the possibilities for application of new fish-culture techniques at Adams Lake require further investigation before any definite proposal can be made. The only sockeye now reared in Kamloops Lake are the small runs to Raft River and Barriere River. The run to Raft River is limited by the small spawning area and is subject to warm water during spawning, and the run to Barriere River also encounters high water temperatures during the spawning period. The situation in these two rivers parallels that at Horsefly River, and before expansion can be undertaken, practical methods of coping with the existing environmental limitations must be found. At Mabel Lake, the small existing sockeye run to Middle Shuswap River has ample spawning ground to support a run which would fully utilize the available rearing capacity. However, the stock has been increasing very slowly, partly because it is not possible to protect this small run by selective fishing regulation. Since a boost in production of fry or smolts is needed to assist the growth of this run, consideration is being given to the practicability of establishing a small experimental hatchery and rearing system at Mabel Lake.

In the lakes downstream from Hope, only a quarter of the rearing capacity is unutilized by the maximum sockeye runs, but the milder climate and longer growing season could result in greater rearing capability than indicated by the index. The facilities now in operation at Upper Pitt River and Weaver Creek, constructed to restore the declining runs to these streams, will increase the utilization of Pitt and Harrison Lakes substantially and will provide further means of assessing the rearing capability of these lakes. However, at present it appears that the potential for expansion is greater elsewhere and, as already indicated, the Commission's current planning is directed toward greater utilization of the northern lakes of the Fraser system.

Previous attempts by other fisheries agencies to rear sockeye fry to the yearing smolt stage have shown that this species is extremely sensitive to the artificial environment of a hatchery rearing system. Frequent and serious mortalities from several causes have been reported. Thus it was not deemed advisable for the Commission to consider a prototype hatchery rearing system for sockeye without ascertaining, on an experimental basis, how to avoid serious mortalities. To accomplish this, the Sweltzer Creek Laboratory was modified to permit a series of sockeye rearing experiments.

Many adverse factors affecting the success of rearing Cultus Lake sockeye from the fry to the smolt stage have been isolated and eliminated through such rearing experiments. Substantial numbers of Cultus Lake sockeye were successfully reared until just prior to the smolt stage in both 1968 and 1969, only to suffer a 100% mortality from a virus disease known as Infectious Hematopoietic Necrosis, or IHN. While this disease, at present uncontrollable, apparently nullifies any attempt at present to rear Cultus Lake sockeye artificially to the smolt stage, fortunately it does not appear to be a factor in controlling the number of smolts produced naturally in Cultus Lake. Transfers of eggs and fry indicate that upriver races of Fraser sockeye do not appear to be subject to the virus even

when reared in Cultus Lake water. In any event, if the Commission continues its rearing experimentation on an enlarged scale, such activity must be removed from Cultus Lake and relocated in an area where the virus does not exist. The rearing operation must also be capable of establishing returning adult runs of sufficient size to justify the expense.

The Commission is aware of the mounting evidence that salmon of other species, although successfully produced by hatchery and rearing operations, may have lost their ability to reproduce naturally or at least had that ability impaired. Forced rates of egg development in the hatchery or forced rate of growth of the young fish, or both, oftentimes required to obtain a sufficient return of adults to make the operation an economic success, apparently upsets the normal functioning of the fish in relation to its natural reproductive environment. Thus adult salmon produced by a hatchery and pond-rearing facility may be unable, in certain cases, to reproduce naturally and the fish-cultural activity which produced them must be continued in order to maintain the population. An upset in the development of sockeye caused by artificial rearing has been observed recently at Cultus Lake. Each spring, thousands of smolts leave Cultus Lake after having spent two years in the lake instead of the usual one year. These two-year-old smolts average about 13.5 cm in length. A few males return just over a year later as jack sockeye and the majority of the survivors return as five-year-old fish. In contrast, 100 Cultus sockeye held in freshwater rearing tanks for two years averaged 23.2 cm in length and immediately prior to normal departure time for the marine environment (March and April) some of the males reached sexual maturation. These fish not only matured a year earlier than any of their wild counterparts, but were ready to spawn in March and April instead of November when the naturally produced adults appear on their spawning grounds.

On the basis of extensive research, the Commission has avoided the hatchery as a tool for increasing production of sockeye fry and has substituted artificial spawning and incubation channels for this purpose. The success of these channels in producing returning adults, naturally adjusted to their reproductive environment, has been amply justified in the preceding pages. However, these channels require natural rearing areas to be successful. Whether the hatchery with an artificial rearing system can substitute for a possible future loss of both natural spawning grounds and related natural rearing areas has yet to be determined in the case of Fraser River sockeye. Experimentation should be continued towards this end since this type of operation has been eminently successful with certain races of coho and chinook salmon.

PINK SALMON REPORT

The Fishery

A total of 3,753,231 pink salmon entered Convention waters in 1969 of which 3,219,828 or 85.8% were of Fraser River origin. The balance of the run was destined for either Washington State streams (470,329) or Canada non-Fraser streams (63,074). A decline was expected in the 1969 run destined for each of these areas but the drop in run size was greater than anticipated, particularly in

CALCULATED CATCHES AND PERCENTAGE REMOVAL FROM PINK SALMON RUNS ENTERING THE CONVENTION AREA IN 1965, 1967 AND 1969

	Source of Run											
	United States			*Fraser River*			*Canada Non-Fraser*			*Total*		
	1965	1967	1969	1965	1967	1969	1965	1967	1969	1965	1967	1969
TOTAL ENTERING CONVENTION AREA	1,344,350	1,405,127	470,329	1,912,367	9,152,687	3,219,828	123,706	153,196	63,074	3,380,423	10,711,010	3,753,231
CATCH IN CANADIAN CONVENTION WATERS												
Westerly of William Head	244,722	425,362	81,826	222,567	3,152,652	507,296	15,169	34,958	15,968	482,458	3 612,972	605,090
Easterly of William Head	—	—	—	107,009	534,693	254,503	3,000	9,257	1,912	110,009	543,950	256,415
Total	244,722	425,362	81,826	329,576	3,687,345	761,799	18,169	44,215	17,880	592,467	4,156,922	861,505
Per Cent Removal	18.2	30.3	17.4	17.2	40.3	23.7						
CATCH IN UNITED STATES CONVENTION WATERS	115,812	116,698	17,470	390,972	3,633,970	906,450	51,596	76,372	21,877	558,380	3,827,040	945,797
Per Cent Removal	8.6	8.3	3.7	20.4	39.7	28.1						
TOTAL CATCH IN CONVENTION AREA	360,534	542,060	99,296	720,548	7,321,315	1,668,249	69,765	120,587	39,757	1,150,847	7,983,962	1,807,302
Per Cent Removal	26.8	38.6	21.1	37.7	80.0	51.8						

the run to the Fraser River where substantial numbers of fry had been produced in the brood year. Fry production was reported to have been very poor in Washington State streams in 1968 and is believed to have been low in the Canadian non-Fraser streams because of flood conditions.

Regulatory restrictions were instituted to protect the potential of each component run but it was impractical to fully protect any except that destined for the Fraser River. Of the latter population, only 51.8% of the fish were harvested, down from an 80% catch in the brood year. Only 21.1% of the Washington State run entering Convention waters were caught. A total of 82.46% of this catch was made in Canadian Convention waters lying westerly of William Head. Special closures were applied in the Canadian net fishery to protect this population as much as possible, considering the fact that it mixes freely in this area with the large early segment of the Fraser River run. As a result, the total net catch was held to the lowest level possible consistent with a reasonable harvest of Fraser River pink salmon, but a large portion (31,000 out of a total catch of 82,000 fish) of the Canadian Convention waters catch of Washington State pink salmon originated from the Canadian high seas troll fishery west of William Head. Special fishing closures in those United States Convention waters where the Washington State fish tend to separate from pink salmon destined for the Fraser River resulted in only 3.7% of the Washington State run being taken in this area.

The relatively small run to the Fraser River in 1969 represents the third poor run in the last five cycle years, an unprecedented occurrence in the 70-year recorded history of the fishery. Relationships established over four previous decades between freshwater and estuarial environments and the size of returning pink salmon runs fail to indicate any reason for the frequent low fry-to-adult survival rates of recent years. With substantial spawning escapements and fairly large emigrations of fry, the potential for large runs of Fraser pink salmon has been established each year. However, there is some evidence that early season emigration of the fingerlings from the estuarial area to the high seas may be associated with poor survival. Study of this area is most difficult because of complex ecological factors, but investigations are under way within the limited budget available to the Commission. It is interesting to note that in Alaska, measurement of the success of pink salmon incubation is proving successful in predicting adult runs. In contrast, measurements of fry production and even observations of fingerling abundance in Georgia Strait seem to be of little value in recent years in assessing the survival capability of Fraser River pink salmon.

Although the production of Fraser River pink salmon reached unprecedented low levels in 1961, 1965 and 1969, the future potential of the run has not been impaired because fairly large escapements were obtained in each of the three cycle years. The large run in 1967 obtained from one such escapement gives assurance that the potential is being maintained by careful management of this fishery.

Unlike the Fraser River, where, with the exception of the Chilliwack-Vedder River, floods have little adverse effect on pink salmon fry production, the neighboring Washington State streams and Canada non-Fraser streams have suffered both a low fry production and a low fry-to-adult survival rate in recent years. The

run to Washington State streams has declined in three cycle years from one of great abundance to one insufficient in numbers to provide a satisfactory escapement, let alone maintain a fishery. During adult migration, this population separates from the Fraser River run when it reaches the United States Convention waters south of Salmon Banks, thus providing a means of giving it almost total protection while passing through this southern area. Fraser River pink salmon can be adequately harvested by United States fishermen in more northern waters from Salmon Banks to Point Roberts where negligible numbers of Washington State fish are present with the exception of those destined for the Nooksack River. Unfortunately, however, Washington State pink salmon and the large early segment of Fraser River pink salmon migrate as a mixed population at exactly the same time through the high seas troll fishery and the Canadian net fishery in Juan de Fuca Strait. If Canadian net fishermen are to harvest their share of first quality Fraser River pink salmon in Juan de Fuca Strait, Washington pink salmon will of necessity be harvested at the same time. It is hoped that the survival rates of Washington State pink salmon will permit an early increase in this component run, otherwise a major problem will be created involving the question of how Canada can harvest its share of first quality Fraser River pink salmon in Juan de Fuca Strait without impairing the future potential of the Washington State runs. It should be noted once again that the high seas troll fishery harvested a substantial part of the 81,826 pink salmon destined for Washington streams that were taken by Canadian fishermen in 1969.

Badly needed protection of the pink salmon runs to Canada non-Fraser streams by special fishing restrictions is even more involved and more difficult to accomplish in Convention waters than for the Washington stocks. The Canada non-Fraser pink salmon, along with those destined for the Nooksack River in Washington State, arrive in the fishery in late July and early August at the same time as the peak of the mid-summer sockeye runs. Since these summer run sockeye can be harvested in the Fraser River while of satisfactory quality, the early running pink salmon can receive major protection by a delayed opening of the Canadian net fishery in Juan de Fuca Strait. However, if United States fishermen are to harvest their allowable share of the important summer run sockeye to the Fraser River, they will of necessity harvest a substantial number of the pink salmon of Canada non-Fraser origin desired for escapement. Fortunately, catch statistics show that in most years a major share of the Canada non-Fraser run approaches its reproducing area from the north, entirely through non-Convention waters. However, the same problem appears to exist in the northern non-Convention waters that occurs in United States Convention waters; that is, how to harvest the available and valuable sockeye salmon without impairing the escapement of pink salmon when the latter is at a dangerously low level of abundance.

Perhaps a return to more favorable survival rates will soon restore the pink salmon populations originating in Washington State and Canada non-Fraser streams to their full potential existing only three cycles ago. If these populations do not increase in abundance even under the maximum practical restrictions of the fishery imposed both within and outside Convention waters, artificial aids to production may need to be considered, if such aids are found to be economically feasible.

Escapement

The total 1969 escapement of pink salmon to the Fraser River was 1,529,000 fish from an estimated total Fraser River run of 3,830,000 or nearly 40% of the total run. Of the estimated 3,220,000 pink salmon available in Convention waters, this escapement comprised approximately 47%. This percentage escapement is up substantially from the 20% recorded in the much larger 1967 brood year, and was made possible only by major restriction of the commercial fishery on the small 1969 run. As a result, the numerical escapement obtained in 1969 was nearly as large as in 1967, and is considered sufficient to provide a good potential for the 1971 run.

The early segment of the 1969 escapement was substantial, being the largest to the main Fraser area since the 1957 cycle year. The only significant decline in the escapement of early segment fish occurred in the Thompson River. Although the largest spawning population since 1911 had been recorded in the brood year of 1967 (Table XIV), the 1969 escapement to the Thompson River declined 45%. It is noted once again that in spite of this 45% decrease, the Seton Creek escapement declined only 12%. Since there was an estimated loss of 10 million naturally hatched fry due to the inadvertent flooding of Seton Creek in the brood year, strong evidence is presented as to the value of the two artificial spawning channels on Seton Creek in maintaining this population in years of low fry-to-adult survival.

The escapement of late running pink salmon showed a much desired increase in the Harrison River, whereas the escapement to the Chilliwack-Vedder system declined substantially. The latter reflects the flood conditions which prevailed both during and after spawning as recorded in the 1967 Annual Report. The Chilliwack-Vedder River is the only major pink salmon spawning ground in the Fraser system subject to the same flooding conditions which have contributed so drastically to the recent decimation of the Washington State and Canada non-Fraser pink salmon runs. An extensive artificial spawning channel to ameliorate the periodic adverse effects from natural flooding has been designed, the land and water rights have been obtained, and construction awaits only the granting of the required funds.

Fraser River Pink Salmon Production

	Brood Year			
	1961	1963	1965	1967
Total Spawners	1,094,000	1,953,000	1,191,000	1,831,000
Female Spawners	654,000	1,217,000	692,000	1,015,000
Potential Egg Deposition	1,569,200,000	2,434,800,000	1,487,800,000	2,132,067,000
Fry Production	143,600,000	284,200,000	274,000,000	237,600,000
Adult Return (Catch + Escapement)	5,262,000	2,217,000	12,740,000	3,830,000
Freshwater Survival	9.2%	11.7%	18.4%	11.1%
Marine Survival	3.7%	0.8%	4.6%	1.6%
Return Per Spawner	4.81	1.14	10.70	2.09

The number of females permitted to enter the two Seton Creek spawning channels was reduced in 1969 as a test to determine the actual optimum number of female spawners per square yard compared with the theoretical optimum number, the latter being used in previous years of operation. Redd sampling indicates that the success of hatch may improve to a point where more fry will be produced by the smaller number of female spawners.

Pink Salmon Fry Production at Seton Creek

Brood Year	*Total Escapement to Creek and Channels*	*Channel*	*Channel Only*				
			Spawning Population	*Female Spawners*	*Egg Deposition*	*Fry Produced*	*Per Cent Survival*
1961	58,717	Upper	6,711	3,322	6,860,000	3,592,000	52.4
1963	121,424	Upper	14,106	8,107*	16,022,000	3,480,000	21.7
1965	95,046	Upper	7,000	4,082	7,767,000	2,681,000	34.5
1967	255,351	Upper	7,143	3,985	7,154,000	3,180,000	44.4
		Lower	20,630	12,435	22,322,000	8,977,000	40.2
1969	198,854	Upper	3,975	2,452	4,781,000		
		Lower	14,868	8,717	16,998,000		

* Excess numbers entered channel due to a break in the control fence.

Water levels in the Fraser and Thompson Rivers in 1969 were considered higher than the optimum for successful spawning and will no doubt reduce to some degree the egg-to-fry survival rate in these major spawning areas. Spawning and incubation conditions in the Chilliwack-Vedder River were considered the best in years. Similar favorable conditions for good egg-to-fry survival reportedly existed in Washington State and Canada non-Fraser streams.

WATERSHED PROTECTION

The Commission and the fishing industry have been concerned over the failure of the Adams River sockeye run to maintain its abundance following the record-breaking run in 1958. Engineering surveys and studies of spawning habits of this population have led to the conclusion that fry production has been reduced in the last three dominant cycle years because of a natural change in flow distribution between the two major spawning channels in the lower river delta. Adequate water is available in both channels of Adams River at spawning time but the winter flow in the right channel is now so low, receiving only 10% of the total, that extensive exposure of spawning beds occurs. Figures 2 and 3 show the two channels during the low flow period. Spawning density counts have revealed that the major share of the dominant run continues to spawn in the right channel in spite of subsequent low water exposure, and corrective measures are required to restore normal production rates. Access rights have been obtained from the Indian Band controlling the adjacent land, and a permit has been secured from the Province to change the flow distribution, making it possible to increase and maintain the water supply to the right channel during spawning and incubation of the 1970 dominant Adams River population.

FIGURE 2—Looking downstream at the point of separation of the right and left channels of the Lower Adams River during the low flow period. The major share of the escapement continues to spawn in the right channel since favorable flows exist at spawning time. Investigation has revealed that only 10% of the available water flows down the right channel during the low water period.

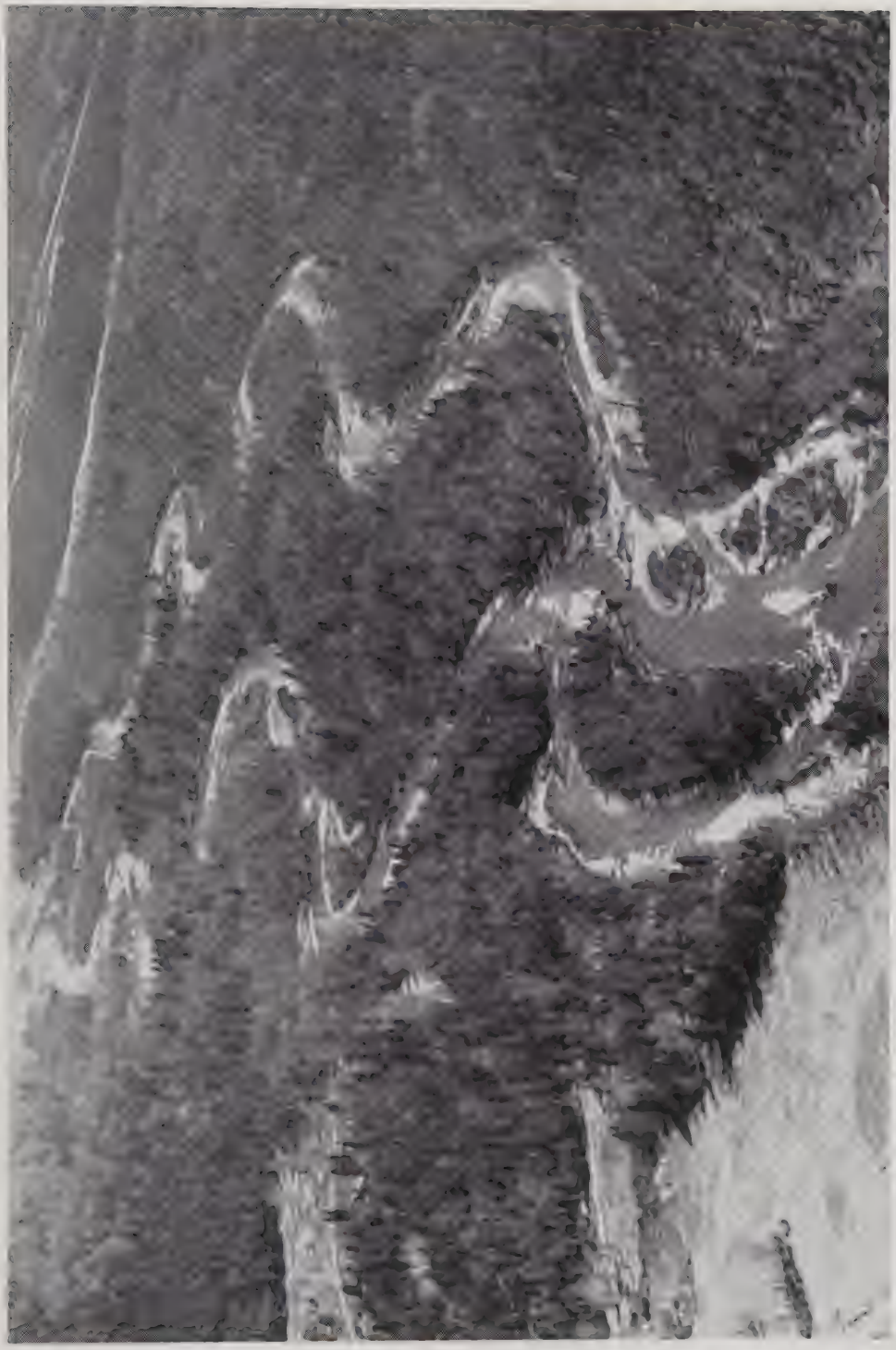

FIGURE 3—An aerial picture of the Lower Adams River delta from the point of separation of the right and left channels to Shuswap Lake in the background.

Construction of the temperature control project on McKinley Creek was completed in June 1969, with the installation of 2,400 feet of 66-inch-diameter pipe on the lake bottom. This pipe can withdraw from 50 to 80 cfs of cold water from the bottom of McKinley Lake, which can be mixed with the required amount of surface water to control the temperature of McKinley Creek at the outlet of McKinley Lake. The completed installation was operated from August 12 to 31, 1969, and regulated the temperature in McKinley Creek during the sockeye spawning period to a maximum of 57°F over the major spawning areas located in the upper half of the creek. The project successfully controlled columnaris disease in the sockeye spawners in McKinley Creek, which otherwise would have been subjected to temperatures as high as 68°F. However, as previously reported, a large prespawning mortality of sockeye occurred in McKinley Creek and Horsefly River despite suitable water temperature, and further investigations are required before giving further consideration to the need for temperature control in Horsefly River.

During August, the foundation for a self-collapsing rack was constructed in Weaver Creek just upstream from the entrance to the spawning channel. The rack was installed in October and successfully diverted 17,089 sockeye spawners into the channel.

Investigation of the fisheries problems that would be associated with the proposed diversion of water from Shuswap River to Okanagan Lake, conducted jointly by the Commission and the Department of Fisheries and Forestry of Canada, was completed and a report was submitted to the Minister of Fisheries. In October, a Federal-Provincial agreement was signed providing $1,800,000 for a four-year joint study of the water resources of the Okanagan Basin. Pending completion of this study, the proposal to divert water from Shuswap River is being held in abeyance.

Another Federal-Provincial agreement, signed in 1968, provides for construction of flood control works in the lower Fraser Valley and for a review of previous studies of potential reservoir developments in the upper Fraser River Basin. The agreement extends for a 10-year period, and costs are to be shared equally up to $18,000,000 each, with additional contributions from the municipalities concerned. The Department of Fisheries and Forestry of Canada has representation on the Joint Program Committee formed to implement the program.

The proposal to construct a pulp mill at Ashcroft, reported in 1968, did not proceed and it is understood the proposal has been dropped. The proposal of Cariboo Pulp and Paper Company to construct a 750-ton-per-day bleached kraft pulp mill at Quesnel was reactivated late in 1969. Satisfactory discussions have been held with representatives of the Company concerning waste handling and treatment facilities, to ensure the treated effluent will meet requirements of the Department of Fisheries and Forestry of Canada.

Three technical staff meetings were held with representatives of Northwood Pulp Limited to discuss modification of the waste handling and treatment facilities at their mill at Prince George, considered necessary to comply with effluent speci-

fications of the Department of Fisheries and Forestry of Canada. The discussions were concerned primarily with removal of suspended solids and reduction in biochemical oxygen demand and toxicity of the effluent. Proposed modifications for preventing discharge of suspended solids were considered acceptable, but proposed minor changes in the biological treatment basins were considered insufficient for effluent treatment and were not acceptable to the Commission or the Department of Fisheries and Forestry of Canada. The matter has now been placed before the Minister of Fisheries.

1969 PUBLICATIONS

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1968.

2. Progress Report Number 21.
Effect of Feeding Before and After Yolk Absorption on the Growth of Sockeye Salmon by D. A. Hurley and E. L. Brannon.

3. Progress Report Number 22.
Implication of Water Quality and Salinity in the Survival of Fraser River Sockeye Smolts by I. V. Williams.

4. Progress Report Number 23.
Marine Disposal of Sediments from Bellingham Harbor as Related to Sockeye and Pink Salmon Fisheries by J. A. Servizi, R. W. Gordon and D. W. Martens.

5. Administrative Report (restricted circulation).
Proposed Artificial Spawning Channel for Chilliwack River Pink Salmon.

6. Administrative Report (restricted circulation).
Report on the Fisheries Problems Associated with the Proposed Diversion of Water from Shuswap River to Okanagan Lake. Prepared by the technical staffs of the Department of Fisheries and Forestry of Canada and the International Pacific Salmon Fisheries Commission in collaboration with the Fish and Wildlife Branch, British Columbia Department of Recreation and Conservation.

TABLE I

SOCKEYE CATCH BY GEAR

United States Convention Waters

Year	Purse Seines			Gill Nets			Reef Nets			Troll		Total Catch
	Units	Catch	Per Cent	Units	Catch	Per Cent	Units	Catch	Per Cent	Catch	Per Cent	
1969	270	991,598	62.51	519	517,650	32.64	44	76,570	4.83	358	0.02	1,586,176
1965	169	740,123	72.13	388	236,133	23.01	55	49,707	4.84	155	0.02	1,026,118
1961	273	823,956	59.76	574	471,464	34.20	77	81,826	5.94	1,146	0.10	1,378,392
1957	234	1,237,665	73.27	638	286,614	16.97	87	164,951	9.76	35	<0.01	1,689,265

Canadian Convention Waters

Year	Purse Seines			Gill Nets			Troll		Total Catch
	Units	Catch	Per Cent	Units	Catch	Per Cent	Catch	Per Cent	
1969	149	340,187	20.30	1,307	1,268,525	75.71	66,824	3.99	1,675,536
1965	89	85,914	8.27	1,501	944,266	90.87	9,015	0.86	1,039,195
1961	101	352,883	26.00	1,550	991,972	73.10	12,244	0.90	1,357,099
1957	104	522,426	38.39	1,309	820,850	60.32	1,725	0.13	1,360,760*

* Includes 15,759 trap caught sockeye.

NOTE: Gear counts represent the maximum number of units delivering sockeye on any single day.

Table II

CYCLIC LANDINGS AND PACKS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1969			
Total Landings (No. Sockeye)	1,586,176	1,675,536	3,261,712
Share in Fish	48.63%	51.37%	
Total Pack (48-lb Cases)	128,926	141,623	270,549**
Share in Pack	47.65%	52.35%	
1965			
Total Landings (No. Sockeye)	1,026,118	1,039,195	2,065,313
Share in Fish	49.68%	50.32%	
Total Pack (48-lb Cases)	84,430	89,738*	174,168
Share in Pack	48.48%	51.52%	
1946-1969			
Total Landings (No. Sockeye)	38,847,407	38,118,077	76,965,484
Share in Fish	50.47%	49.53%	
Total Pack (48-lb Cases)	3,392,789	3,302,864	6,695,662
Share in Pack	50.67%	49.33%	
1969 *Cycle Catch*			
1969	1,586,176	1,675,536	3,261,712
1965	1,026,118	1,039,195	2,065,313
1961	1,378,392	1,357,099	2,735,491
1957	1,689,265	1,360,760	3,050,025
1953	2,032,437	1,992,343	4,024,780
1949	1,056,792	1,020,799	2,077,591
1945	706,464	969,444	1,675,908
1941	1,558,554	2,116,723	3,675,277
1937	897,022	1,075,986	1,973,008
1933	1,724,127	726,309	2,450,436
1929	1,334,141	725,037	2,059,178
1925	1,375,012	453,704	1,828,716
1921	1,199,929	486,312	1,686,241
1917	5,005,609	1,877,792	6,883,401
1913	21,736,398	9,606,641	31,343,039
1909	13,664,988	7,261,486	20,926,474
1905	10,330,277	10,350,959	20,681,236
1901	13,694,032	12,065,999	25,760,031

* Includes 542 cases packed in Canada from sockeye caught in United States Convention waters.

** Pack adjusted to include 135,810 sockeye caught by United States fishermen and 684 caught by Canadian fishermen sold on the fresh and frozen market.

TABLE III

DAILY CATCH OF SOCKEYE, 1957-1961-1965-1969 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1957	1961	1965	1969	1957	1961	1965	1969	1957	1961	1965	1969
1	10,165			6,906		128,699						
2	11,833			4,731		75,733	3,137		7,288			4,142
3	13,977	47,926					1,445	122,566	25,515			3,683
4		43,037					52,146	77,758	19,653			
5		28,585	26,335		247,511		65,290	63,332		CLOSED		
6			21,773		135,265							
7				1,824							932	
8	42,804			1,931							358	18
9	57,639			2,324			55,149		1,852		181	78
10	23,464	143,287				82,844	30,297		3,333			981
11		89,786					14,893	42,399	4,583			266
12			20,836		169,312			18,044	1,451			
13			15,456		121,946			15,558	5		62	
14				16,173	71,364			12,433			16	
15	39,662			9,948		18,748					0	191
16	37,687					5,241	13,584		109		0	30
17	33,138	49,754					8,584		610			2
18		43,233						17,370	170	22		
19		34,815	43,747		49,619			23,237		10		
20			74,983		45,223					6	20	
21			84,674	221,188	28,689	11,491					23	
22	95,124			156,203	27,606	6,038					57	98
23	78,735			182,627					24		40	699
24	52,762	199,232							29			91
25		117,345					7,728	19,605	8	11		41
26		73,843			22,237	CLOSED	3,863	17,334		33		
27					16,538					10	43	
28			262,812	230,072	12,724						9	
29	63,287		172,566	201,102	7,420						10	1,004
30	61,061			92,332							0	294
31	46,297	161,484										
Totals	667,635	1,032,327	723,182	1,127,361	955,454	328,794	256,116	429,636	64,630	92	1,751	11,618
Troll and Outside Seine		750	104	131		380	46	210			1	1
Monthly Totals	667,635	1,033,077	723,286	1,127,492	955,454	329,174	256,162	429,846	64,630	92	1,752	11,619
June and October Totals									1,546	16,049	44,918	17,219
Season Totals									1,689,265	1,378,392	1,026,118	1,586,176

Table IV

DAILY CATCH OF SOCKEYE, 1957-1961-1965-1969 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1957	1961	1965	1969	1957	1961	1965	1969	1957	1961	1965	1969
1	19	STRIKE RELIEF FISHING		10,842	36,393	109,677						1,272
2	274			10,654			206,017		9,419			709
3	1,658	36,879					79,921		4,956			
4	1,157	7,930					29,092	178,581	3,328			
5			35,176		83,204			81,629	1,920	53		
6			8,184		138,428			51,902	1,619	18		
7					52,297						133	286
8	68										106	163
9				5,363		28,636	20,830		67		59	177
10	4,529	109,597				23,368	63,820		11,153			287
11	67	27,730					24,820	34,096	6,060			
12		34,089	19,440		37,115			62,362	3,340	7		
13		46,966	5,750		104,138	52,261		15,882	1,833	4	27	
14				22,096	81,215	18,609					10	
15					85,221	21,972					9	
16	31,184					7,407	9,770		2,753		11	
17	17,143	86,946					26,163		4,224			45
18	17,281	44,527					4,618	8,471	2,102			16
19			73,372		24,722			4,830	763	2		
20			22,946		62,386			13,310	924	3	4,335	
21			13,577	96,953	40,463	17,815				2	8	
22	72,300			30,593	31,909	5,898					3	
23	82,253											15
24	53,025	217,241							1			35
25	20,679	153,593					6,790					
26		98,121			25,088		1,481	5,907		11		
27			179,102	368,974	12,623						18	
28			69,415	229,115	9,799	5,630				1	3	
29	13,254		76,955	160,326	1,836	1,831					3,182	
30	83,664		10,080	91,292			4,562	1,159				18
31	75,599	179,254		79,400				1,160				
Totals	474,154	1,042,873	513,997	1,105,608	826,837	293,104	477,884	459,289	54,462	101	7,904	3,023
Troll and Outside Seine	662	4,976	6,687	43,240	1,001	2,363	2,183	18,802	37	4,236	50	4,419
Spring Salmon Gill Nets				3,079						625	569	8,288
Monthly Totals	474,816	1,047,849	520,684	1,151,927	827,838	295,467	480,067	478,091	54,499	4,962	8,523	15,730
June, Oct. and Nov. Totals									3,607	8,821	29,921	29,788
Season Totals									1,360,760	1,357,099	1,039,195	1,675,536

TABLE V

THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE VARIOUS AREAS WITHIN THESE DISTRICTS, 1965, 1969

	1965		1969	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Skookumchuck and Douglas	1,330	19	381	8
Birkenhead River and Lillooet Lake	4,470	36	3,860	21
Harrison and Chehalis	1,100	46	900	15
TOTALS	6,900	101	5,141	44
LOWER FRASER				
Coquitlam to Chilliwack	18,010	82	3,932	32
Chilliwack to Hope	13,550	69	25,846	50
Vedder River and Vicinity	10,800	100	2,358	19
TOTALS	42,360	251	32,136	101
CANYON				
Hope to Lytton	36,400	184	39,005	198
TOTALS	36,400	184	39,005	198
LYTTON TO LILLOOET				
Lytton to Lillooet	4,800	70	11,205	124
TOTALS	4,800	70	11,205	124
BRIDGE RIVER RAPIDS				
Rapids	7,200		32,552	362
Pavillion	2,300		10,398	160
TOTALS	9,500	140	42,950	522
CHILCOTIN				
Farwell Canyon	22	7	639	22
Hances Canyon	247	10	327	10
Alexis Creek	216	30	540	20
Siwash Bridge	342	32	1,033	35
Keighley Holes	131	4	578	13
TOTALS	958	83	3,117	100
UPPER FRASER				
Shelley	254		163	18
Alkali and Canoe Creek	513		609	12
Chimney Creek	2,899		3,454	70
Soda Creek	1,025		1,150	28
Alexandria	792		490	19
Quesnel	746		460	17
TOTALS	6,229	138	6,326	164
NECHAKO				
Nautley Reserve	2,250	17	2,463	21
Stella Reserve	1,705	19	1,866	15
TOTALS	3,955	36	4,329	36
STUART				
Fort St. James	3,958	37	6,908	40
Tachie, Pinchi and Trembleur Villages	3,685	68	6,192	48
TOTALS	7,643	105	13,100	88
THOMPSON				
Main Thompson River	1,100	90	850	7
North Thompson River	250	42	560	27
South Thompson River	475	103	25	110
TOTALS	1,825	235	1,435	144
GRAND TOTALS	120,570		158,744	

* Number of permits issued to Indians in district.

The Indian catch statistics detailed above are obtained principally from the Protection Officers of the Department of Fisheries and Forestry of Canada. These officers control the taking of sockeye for food by the Indian population residing throughout the Fraser River watershed.

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1957, 1961, 1965, 1969

District and Sreams	1969 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio	
		1957	1961	1965	1969		Males 4-5 yr.	Females 4-5 yr.
LOWER FRASER								
Cultus Lake	Nov. 17-24	20,647	15,428	2,532	6,739	797	2,761	3,181
Upper Pitt River	Sept. 9-10	12,338	11,162	6,981	24,905	11	13,038	11,856
Widgeon Slough	——	1,200	1,293	275	715	0	397	318
HARRISON								
Big Silver Creek	Sept. 12-14	389	398	596	85	0	42	43
Harrison River	Nov. 13-16	3,812	42,778	15,034	15,209	47	7,358	7,804
Weaver Creek	Oct. 27-30	20,887	4,383	11,162	58,922	226	26,721	31,975
Misc. Streams	Sept. 15-18	——	11	50	54	0	27	27
LILLOOET								
Birkenhead River	Sept. 23-26	24,168	49,627	30,008	63,343	26,936	13,649	22,758
SETON - ANDERSON								
Gates Creek	Aug. 22-24	1,112	252	1,679	881	104	271	506
Portage Creek	Oct. 28-31	470	527	2,108	1,040	77	463	500
SOUTH THOMPSON								
Seymour River	Aug. 20-28	14,095	5,822	6,954	7,327	151	3,576	3,600
Scotch Creek	Aug. 22-29	2,354	598	1,910	3,395	0	1,641	1,754
Lower Adams River	Oct. 14-18	257,614	57,796	55,041	45,908	41,576	2,085	2,247
Little River	Oct. 17-20	34,964	8,253	3,236	6,775	6,194	279	302
South Thompson River	Oct. 17-20	14,645	254	192	630	576	26	28
Misc. Streams	Oct. 14-18	——	——	1,022	1,917	899	453	565
NORTH THOMPSON								
Raft River	Aug. 25-29	7,264	7,301	6,624	5,594	56	2,597	2,941
Barriere River	Aug. 28-Sept. 3	38	335	104	40	0	20	20
North Thompson River	——	——	——	225	Present	——	——	——
CHILCOTIN								
Chilko River	Sept. 19-22	140,765	40,315	39,902	76,518	5,616	28,491	42,411
Taseko Lake	——	3,667	80	Present	Present	——	——	——
QUESNEL								
Horsefly River	Aug. 27-Sept. 1	226,378	295,705	359,232	270,023	5	111,651	158,367
Mitchell River	Sept. 7-10	2,677	6,601	5,335	8,939	0	3,576	5,363
NECHAKO								
Endako River	——	110	0	2	0	0	0	0
Nadina River (Early)	Aug. 25-29	30,000	18,885	3,884	8,541	0	3,849	4,692
(Late)	Sept. 17-19	29,146	17,544	11,293	27,898	3	10,425	17,470
Nithi River	Aug. 20-24	1,186	146	34	140	0	62	78
Ormonde Creek	——	450	0	0	0	0	0	0
Stellako River	Sept. 25-28	38,922	47,241	39,418	49,341	130	20,756	28,455
STUART								
Early Runs								
Ankwil Creek	July 29-Aug. 3	8,285	18,468	2,806	15,795	17	7,203	8,575
Bivouac Creek	July 30-Aug. 2	9,464	997	401	952	0	400	552
Driftwood River	Aug. 2-5	45,567	81,617	4,221	52,873	58	24,110	28,705
Dust Creek	July 29-Aug. 3	14,827	10,870	1,584	3,595	0	1,685	1,910
Felix Creek	July 28-Aug. 2	7,081	3,082	1,404	5,879	0	3,131	2,748
15 Mile Creek	July 29-Aug. 2	511	922	74	209	0	98	111
5 Mile Creek	July 29-Aug. 3	3,821	731	40	902	0	423	479
Forfar Creek	July 28-31	17,975	13,599	2,221	9,922	9	3,876	6,037
Forsythe Creek	Aug. 3-5	6,385	5,836	553	2,248	0	935	1,313
Frypan Creek	July 29-Aug. 3	3,890	10,595	275	3,145	0	1,519	1,626
Gluske Creek	July 30-Aug. 2	21,899	5,652	2,200	4,660	6	1,959	2,695
Kynoch Creek	July 31-Aug. 4	13,473	16,170	2,885	12,380	31	5,760	6,589
Leo Creek	July 29-Aug. 3	10,620	1,624	121	571	0	266	305
Narrows Creek	July 29-Aug. 3	16,184	7,897	1,377	5,746	6	2,691	3,049
Paula Creek	July 28-Aug. 2	7,918	1,400	79	794	0	423	371
Rossette Creek	July 30-Aug. 2	7,087	4,993	1,165	1,566	53	706	807
Sakeniche River	July 29-Aug. 3	6,340	5,278	4	691	0	324	367
Sandpoint Creek	July 29-Aug. 3	20,914	3,523	706	693	0	323	370
Shale Creek	July 29-Aug. 3	1,606	2,392	79	706	0	332	374
25 Mile Creek	——	724	1,663	229	0	0	0	0
Misc. Streams	July 29-Aug. 2	10,462	3,911	621	2,335	0	1,093	1,242
Late Runs								
Kazchek Creek	Sept. 10-13	19,582	15,676	3,292	178	0	77	101
Kuzkwa Creek	Sept. 15-20	50,006	39,245	10,000	8,370	1	3,273	5,096
Middle River	Sept. 15-18	332,098	177,516	139,186	111,322	31	47,707	63,584
Pinchi Creek	Sept. 18-22	6,390	527	Present	756	0	296	460
Sakeniche River	——	592	1,094	11	0	0	0	0
Tachie River	Sept. 17-20	118,252	177,047	62,469	84,343	11	32,983	51,349
NORTHEAST								
Upper Bowron River	Aug. 25-29	12,069	7,460	2,660	3,872	0	1,936	1,936
TOTALS*		1,663,320	1,253,012	845,418	1,019,544	83,627	397,821	538,096

* Totals include small numbers of fish in small tributaries not listed in the table.

TABLE VII

DAILY CATCH OF SOCKEYE, 1954-1958-1962-1966 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1954	1958	1962	1966	1954	1958	1962	1966	1954	1958	1962	1966
1	1,332						25,695	131,250	472,636	170,818		
2	6,000				30,780		16,883	104,089	446,988	326,983		
3					39,131			104,338	173,977	218,732	142	
4				CLOSED	40,284	27,722		56,763		182,785	897	
5	16,232				29,590	17,753		73,479		255,742	553	8,986
6	8,509				33,758	9,482	32,790		117,704	361,549	37,491	4,292
7	6,623						33,759		115,016	278,614	17,758	9,196
8	12,660	CLOSED					42,145	76,199	66,966	251,967		4,756
9	8,676				91,674			66,840	71,330	270,105		
10					105,771			40,168	42,100	99,657	331	
11			CLOSED	2,317	90,326	47,540		45,066	10,441	83,545	4,921	
12	22,095			1,968	97,704	52,692		51,407	7,646	74,324	5,584	3,262
13	18,854				46,749	48,236	41,499	26,894	8,952	71,025	542	980
14	10,979						13,444		8,796	100,305		1,686
15	10,248							44,307	10,409	44,837		511
16	12,450				36,495			43,556	2,412	22,421		
17					72,456			51,893	1,229	80,171		
18				6,902	39,634			22,143	635	13,319	452	
19	38,708			6,154	28,883			17,494	397	4,598	1,337	8,131
20	30,317				58,703	51,984	30,235		1,328		160	11,012
21	27,814	4,014				67,331	52,410		1,399			12,804
22	24,719	6,199			91,515	62,943		73,061	1,239	22,260		6,364
23	32,708	4,346	11,312		114,790			94,884	457	277,405		
24			12,930		83,238				308	6,769		
25			22,666	28,951	131,074	162,816			24	17,815	92	
26			25,538	34,784	154,114	116,752			358		800	145
27	74,196			41,679	232,693	156,081			401		93	186
28	51,039	19,972				195,990			430			33
29	43,155	10,697			406,321	218,385	183,264		159	42,564		8
30	35,233	8,253	53,588		291,987	249,106		11,044	96	145,499		30
31			33,591		359,793	173,652	52,971	6,457				
Totals	492,547	53,481	159,625	122,755	2,707,463	1,658,465	525,095	1,141,332	1,563,833	3,423,809	71,153	72,382
Troll and Outside Seine	3,566	26	388	75	32,348	1,092	426	287		109	23	
Monthly Totals	496,113	53,507	160,013	122,830	2,739,811	1,659,557	525,521	1,141,619	1,563,833	3,423,918	71,176	72,382
June, Oct. and Nov. Totals									6,501	120,334	1,927	384
Season Totals									4,806,258	5,257,316	758,637	1,337,215

Table VIII

DAILY CATCH OF SOCKEYE, 1954-1958-1962-1966 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1954	1958	1962	1966	1954	1958	1962	1966	1954	1958	1962	1966
1	2,203	831						227,815	91,014	385,773		
2	250	1,695	2,469		152,014			102,476	152,294	466,479		
3			6,116		72,397			44,215	120,470	401,799	85,937	
4				9,042	34,165	22,502		48,348		458,172	50,972	
5	14,594			9,990	58,122	7,241			9,963	175,892	8,832	438
6	10,423				36,874	5,521	70,736		166,818		45,204	6,858
7	7,710	7,239					20,880	134,957	128,713		1,806	174
8	7,809	4,918						81,319	96,413	159,126		105
9	495	7,149	22,160		398			57,790	101,374	199,470		
10			11,310		3,731			76,573	148,585	141,025	53,283	
11			11,328	9,714	3,731	36,583		55,376		145,470	624	
12	9,652			2,539	3,732	13,238		102,303		130,616	349	174
13	8,436				398	14,050	5,801		206,257		173	16
14	7,172	14,098							151,204			511
15	7,135	11,789					33,515	46,027	180,631	2,486		
16	1,783	16,213	12,460		108,415			44,504	85	2,192		
17			12,708		92,423			48,046	569	1,974		
18				8,073	80,050				901	597	148	
19	18,778			5,050	55,805				904	307	172	760
20	12,751				6,313	105,922	39,664		356			71
21	10,854	12,140				241,232	28,275		606			903
22	15,976	6,642				284,595		70,477	313	119		
23	8,810	9,276	22,916		158,921			48,119	307	74		
24			7,351		235,021				97	66	725	
25				40,159	213,480	196,072			47,355	35	715	
26	71,411			15,177	539,669	219,024			15,658	789	784	530
27	41,306				265,408	339,029			10,204			56
28	33,001	19,301				315,589	50,144		19,086			7,668
29	33,306	9,497				195,690	26,674		9,287	1,198		
30	17,346	11,443	68,666		520,136		33,735	1,689	4,435	391		
31			18,324		48,441		25,720	7,233				
Totals	341,201	132,231	195,808	99,744	2,689,644	1,996,288	335,144	1,197,267	1,663,899	2,674,050	249,724	18,264
Troll and Outside Seine	3,356	350	790	2,603	10,283	3,373	4,417	18,950	103	1,131	291	35
Spring Salmon Gill Nets							1,424	2,970		263	1,540	3,810
Monthly Totals	344,557	132,581	196,598	102,347	2,699,927	1,999,661	340,985	1,219,187	1,664,002	2,675,444	251,555	22,109
May, June, Oct. and Nov. Totals									13,977	433,931	47,261	6,511
Season Totals									4,722,463	5,241,617	836,399	1,350,154

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1954, 1958, 1962, 1966

District and Streams	1966 Period of Peak Spawning	Estimated Number of Sockeye			
		1954	1958	1962	1966
LOWER FRASER					
Cultus Lake	Nov. 17-22	23,756	14,097	27,070	17,464
Upper Pitt River	Sept. 8-11	17,624	10,385	16,585	20,867
Widgeon Slough	Nov. 7-10	1,000	1,152	599	884
HARRISON					
Big Silver Creek	Sept. 25-28	279	——	490	329
Harrison River	Nov. 12-17	28,800	14,701	8,162	32,672
Weaver Creek	Oct. 14-19	28,773	36,199	15,962	20,416
LILLOOET					
Birkenhead River	Sept. 20-23	41,201	33,055	52,146	81,134
SETON-ANDERSON					
Gates Creek	Sept. 8-12	47	81	1,046	592
Portage Creek	Oct. 26-30	3,505	4,803	12,034	31,844
SOUTH THOMPSON					
Seymour River	Aug. 26-31	26,258	78,575	58,104	28,754
Eagle River	Sept. 1-4	4	31	169	338
Scotch Creek	Aug. 26-29	——	——	7	459
Anstey River	——	——	——	77	——
Upper Adams River	Sept. 12-15	205	Present	85	63
Lower Adams River	Oct. 19-28	1,532,820	1,730,609	984,447	1,180,105
Little River	Oct. 19-28	427,850	409,480	115,881	105,288
South Thompson River	Oct. 19-28	87,611	123,864	19,152	10,586
Lower Shuswap River	Oct. 13-16	17,462	9,387	31,205	24,629
Middle Shuswap River	——	0	499	457	1,872
Diverted Sockeye	——	0	1,006,177	0	0
NORTH THOMPSON					
Raft River	Aug. 29-Sept. 3	10,551	10,215	7,613	6,250
Barriere River	——	0	0	14	4
North Thompson River	——	——	——	90	46
CHILCOTIN					
Chilko River	Sept. 22-26	36,534	137,081	92,467	226,702
Taseko Lake	Aug. 28-Sept. 1	3,500	7,538	657	353
QUESNEL					
Horsefly River	Sept. 3-6	279	1,784	1,001	1,607
Mitchell River	——	18	65	5	142
Little Horsefly River	——	——	14	72	4
NECHAKO					
Endako River	Aug. 27-Sept. 1	Present	522	236	5
Nadina River (Early)	Sept. 10-16	2,219	804	450	83
(Late)	Sept. 19-22			1,683	1,784
Nithi River	——	46	5	25	0
Ormonde Creek	Sept. 8-11	538	210	47	5
Stellako River	Sept. 26-Oct. 1	142,632	112,273	124,495	101,684
STUART					
Early Runs					
Ankwil Creek	Aug. 10-14	56	461	290	86
Driftwood River	Aug. 15-20	387	1,897	374	140
Dust Creek	Aug. 12-16	1,168	3,017	1,035	178
Felix Creek	Aug. 6-10	218	515	1,600	979
25 Mile Creek	——	207	218	25	0
15 Mile Creek	——	41	105	25	0
5 Mile Creek	——	5	111	11	0
Forfar Creek	Aug. 8-12	5,702	8,715	4,464	1,739
Frypan Creek	Aug. 10-14	266	57	243	58
Gluske Creek	Aug. 8-12	5,292	1,642	1,841	1,876
Kynoch Creek	Aug. 8-12	14,088	9,477	8,672	3,591
Narrows Creek	Aug. 10-12	2,756	1,823	666	322
Paula Creek	——	36	333	405	0
Rossette Creek	Aug. 8-12	3,836	3,735	4,887	1,645
Sakeniche River	Aug. 10-12	——	500	20	2
Sandpoint Creek	——	508	875	243	0
Shale Creek	Aug. 10-12	279	657	306	50
Misc. Streams	Aug. 10-16	23	492	339	193
Late Runs					
Kazchek Creek	Sept. 11-15	83	369	77	144
Middle River	Sept. 15-19	3,927	7,762	11,706	4,917
Pinchi Creek	Oct. 6-10	5	850	142	76
Tachie River	Sept. 25-30	1,529	13,738	6,764	3,600
NORTHEAST					
Upper Bowron River	Aug. 26-29	10,774	14,871	6,292	2,480
TOTALS*		2,484,698	3,815,826	1,622,960	1,919,336

* Totals include small numbers of fish in small tributaries not listed in the table.

Table X
PINK CATCH BY GEAR

United States Convention Waters

Year	Purse Seines			Gill Nets			Reef Nets			Troll		Total Catch
	Units	Catch	Per Cent	Units	Catch	Per Cent	Units	Catch	Per Cent	Catch	Per Cent	
1969	261	776,533	82.10	236	91,609	9.69	35	37,331	3.95	40,324	4.26	945,797
1967	315	3,203,781	83.71	507	310,744	8.12	50	118,994	3.11	193,521	5.06	3,827,040
1965	230	410,444	73.51	234	48,823	8.74	49	21,264	3.81	77,849	13.94	558,380
1963	357	3,454,287	78.04	262	382,424	8.64	69	89,768	2.03	499,753	11.29	4,426,232

Canadian Convention Waters

Year	Purse Seines			Gill Nets			Troll		Total Catch
	Units	Catch	Per Cent	Units	Catch	Per Cent	Catch	Per Cent	
1969	65	277,592	32.23	854	366,005	42.48	217,908	25.29	861,505
1967	102	2,289,207	55.07	1,767	892,447	21.47	975,268	23.46	4,156,922
1965	89	336,478	56.79	1,268	182,059	30.73	73,930	12.48	592,467
1963	159	2,936,194	70.36	1,246	797,385	19.10	439,709	10.54	4,173,288

NOTE: Gear counts represent the maximum number of units delivering pinks on any single day.

TABLE XI

LANDINGS AND PACKS OF PINK SALMON FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1969			
Total Landings (No. of Pinks)	945,797	861,505	1,807,302
Share in Fish	52.33%	47.67%	
Total Pack (48-lb Cases)	79,801	72,183	151,984*
Share in Pack	52.51%	47.49%	
1969 Catch	945,797	861,505	1,807,302
1967	3,827,040	4,156,922	7,983,962
1965	558,380	592,467	1,150,847
1963	4,426,232	4,173,288	8,599,520
1961	508,544	545,128	1,053,672
1959	2,427,535	2,312,906	4,740,441
1957	2,777,366	2,634,720	5,412,086
1955	4,685,984	4,129,063	8,815,047
1953	4,951,429	4,142,117	9,093,546
1951	5,086,284	2,885,514	7,971,798
1949	6,235,400	3,189,662	9,425,062
1947	8,801,595	3,491,416	12,293,011
1945	5,458,890	1,279,849	6,738,739

* Pack adjusted to include 79,129 pinks caught by United States fishermen and 18,998 pinks caught by Canadian fishermen sold on the fresh and frozen market.

TABLE XII

DAILY CATCH OF PINKS, 1963-1965-1967-1969 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1963	1965	1967	1969	1963	1965	1967	1969	1963	1965	1967	1969
1				13	52,307		7,164				145,934	
2				36	48,241	2,533	8,084		386,713			124,314
3						1,312		2,689	215,316			161,294
4						6,736		1,941	75,268			
5		84			68,013	15,117		2,099	61,129		362,417	
6		124			52,218		199				261,626	
7				23	40,441		6,635			108,690	144,223	
8				25	30,906		10,666			68,470		2,418
9			2	33		14,502			103,803	27,983		8,677
10			29			11,818			193,448			127,783
11			39			11,865		3,627	188,781		157,616	57,856
12	CLOSED	674			102,743			1,783			149,560	
13		483			98,389		24,236	2,521		13,716	124,201	
14				443	84,776		41,126	2,081		4,316	89,874	
15				362			45,622			109		42,946
16			10			29,700	53,414			46		19,249
17			322			26,038						1,072
18			209					17,014	91,403		96,316	
19		1,729			173,834			22,877	24,221		48,221	
20		2,504			166,400					6,185	39,802	
21		2,272		967	181,808		133,050			2,036	17,651	
22	7,831			547			191,662			2,099		16,381
23	19,156		275	665			140,804		26	2,402		19,181
24	17,490		6,873				172,829		41			11,860
25	35,819		6,010			60,960		98,003	23		943	5,347
26	27,844		5,622		427,506	46,508		119,947	14		769	
27	22,440		5,952		349,273					940	323	
28		3,799		2,080	263,222					530		
29	37,626	3,469		2,565	164,078		483,011			335		4,461
30	44,316		3,897	1,259			366,854		12,753	180		2,265
31	44,595		10,619				262,997					
Totals	257,117	15,138	39,859	9,018	2,304,155	227,089	1,948,353	274,582	1,352,939	238,037	1,639,476	605,104
Troll	133,114	21,986	48,377	5,524	327,235	53,630	132,751	32,702	20,550	1,832	9,297	1,267
Monthly Totals	390,231	37,124	88,236	14,542	2,631,390	280,719	2,081,104	307,284	1,373,489	239,869	1,648,773	606,371
June, Oct. and Nov. Totals									31,122	663	8,927	17,600
Season Totals									4,126,232	558,380	3,827,040	945,797

TABLE XIII

DAILY CATCH OF PINKS, 1963-1965-1967-1969 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1963	1965	1967	1969	1963	1965	1967	1969	1963	1965	1967	1969
1				24			528					40,906
2				15		10,495	474		67,539			35,463
3						12,117			182,611		117,540	
4					5,237	10,252		5,777	210,058		134,138	
5					31,344			4,773	178,872		128,994	
6	CLOSED	3			57,540		10,829	5,684			65,626	
7		2			67,174		14,045			17,544	93,898	91,986
8					775		17,863			10,086	100,559	29,915
9						23,992	20,326		24,161	5,416		25,639
10						24,346			131,138			17,039
11						25,866		6,345	91,215		218,008	108,797
12	Strike	10			77,691			3,674			136,118	
13	July 12	10			86,575			4,641		6,151	73,745	
14	to			34	81,750		146,394			4,110	31,250	
15	Aug. 4				106,538		108,014			3,383		
16						49,953	105,629		14,390	3,314		
17			8			43,342			8,865			11,653
18			7			40,776		25,980			29,284	10,891
19		22	4		142,007			12,711			16,313	
20		49			113,020			414		52,695	10,361	
21		182		74	125,864		67,700			718		
22				85	372,486		150,862			383	54,442	
23					187,652		168,186		71,976			2,206
24			328									2,196
25			266			81,419			5,651		10,133	
26			308		12,340	37,969		1,074	1,790		6,294	
27		353	454	273	419,589					317	4,998	
28		147		1,848	243,875		210,531			163		
29		198		2,315	229,443		293,634			32,671		
30		70		2,044	220,827	5,307	239,917	36,049				477
31			1,037	1,324			221,137	49,946				
Totals	0	1,046	2,412	8,036	2,581,727	365,834	1,776,069	157,068	988,266	136,951	1,231,701	377,168
Troll	100,316	14,990	99,288	35,622	214,245	51,148	663,415	150,136	106,578	7,378	197,605	26,298
Spring Salmon Gill Nets									12,894	13,508		55,538
Monthly Totals	100,316	16,036	101,700	43,658	2,795,972	416,982	2,439,484	307,204	1,107,738	157,837	1,429,306	459,004
June, Oct. and Nov. Totals									169,262	1,612	186,432	51,639
Season Totals									4,173,288	592,467	4,156 922	861,505

Table XIV

SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS

District and Streams	1969 *Period of Peak Spawning*	*Estimated Number of Pink Salmon* 1963	1965	1967	1969
EARLY RUNS					
Lower Fraser					
Main Fraser	Oct. 8-15	516,831	543,757	785,797	848,532
Harrison					
Chehalis River	Oct. 10-14	12,394	7,621	5,625	7,147
Fraser Canyon					
Coquihalla River	Oct. 10-16	14,971	3,845	3,045	2,415
Jones Creek	Oct. 10-16	3,500	3,000	3,162	1,779
Misc. Tributaries	Oct. 10-16	4,081	1,057	2,395	450
Seton - Anderson					
Seton Creek	Oct. 10-17	121,424	95,046	225,351	198,854
Portage Creek	Oct. 10-17	8,013	5,931	7,822	1,092
Bridge River	Oct. 12-18	6,422	23,657	6,547	13,034
Thompson					
Thompson River and Tributaries	Oct. 10-18	285,243	233,100	450,487	247,896
Total*		972,879	917,736	1,490,231	1,321,199
LATE RUNS					
Lower Fraser					
Stave River	——	910	226	276	——
Harrison					
Harrison River	Oct. 16-20	645,476	69,213	64,576	96,390
Weaver Creek	Oct. 16-20	693	528	786	725
Chilliwack-Vedder					
Chilliwack-Vedder River	Oct. 21-25	317,750	193,911	252,585	92,222
Sweltzer Creek	Oct. 18-29	15,215	8,908	19,586	18,923
Total*		980,453	273,387	341,141	208,260
Grand Total		1,953,332	1,191,123	1,831,372	1,529,459

* Totals include small numbers of fish in small tributaries not listed in the table.

TABLE XV

SUMMARY OF THE PINK SALMON ESCAPEMENTS TO UNITED STATES AND CANADIAN NON-FRASER RIVER SPAWNING AREAS*

United States Spawning Areas	1963	1965	1967	1969
Nooksack	150,000	12,500	20,000	15,000
Skagit	1,190,000	150,000	100,000	100,000
Stillaguamish	640,000	185,000	105,000	75,000
Snohomish	275,000	185,000	95,000	70,000
Puyallup	10,000	25,000	22,000	16,000
Dosewallips	400,000	125,000	190,000	20,000
Duckabush	100,000	30,000	70,000	20,000
Dungeness	400,000	75,000	95,000	14,400
Elwha	40,000	15,000	10,000	1,500
Miscellaneous	19,000	10,400	19,000	8,200
TOTALS	3,224,000	812,900	726,000	340,100

Canadian Non-Fraser Spawning Areas	1963	1965	1967	1969
Jervis Inlet	211,000	43,275	25,000	31,000
Howe Sound	750,000	81,000	37,000	23,600
Burrard Inlet	200,500	35,250	13,000	8,500
TOTALS	1,161,500	159,525	75,000	63,100

* These data were provided through the courtesy of the Washington State Department of Fisheries and the Department of Fisheries and Forestry of Canada.

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